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EDITORIAL NOTES—GAS, &c.

Mr. Forbes Carpenter on the Results of Modern Carbonizing Methods.

WHEN the members of the Institution of Gas Engineers, at their recent annual meeting, were applauding the recognition by their President (Mr. W. Doig Gibb) of the friendly aiding work of the Chief Inspector under the Alkali, &c., Works Regulation Act (Mr. R. Forbes Carpenter) and the District Inspectors, the forty-fourth annual report of the Chief Inspector was in the press, and has now been issued. It is again a report elucidatory and instructive; and one that takes a broad survey of the extensive affairs that come within the purview of the department. If there is one section of it that will appeal to gas engineers more than any other, it is that headed "Studies in Carbonization." Here there are brought into focus, and into comparison, some of the more attractive features of contemporary carbonizing work, from the standpoint of the diligent student whose training and discriminating and selective capacity are chemical. We have our attention drawn to coke-oven operation, and to the additions made to knowledge, and the problems produced, and given form to, by coal carbonization in vertical retorts. The finger of the student is placed on differing experiences, and on matters that have not been brought within the range of definite solution. Mr. Carpenter's position in this matter is that of the guide, philosopher, and friend; and there is an obvious desire to eschew partizanship as far as is possible. But we claim his authoritative pronouncement on one point as giving support to the attitude taken up in these columns in the matter of the Coalite process.

Mr. Carpenter does not refer to that process; but, in dealing with coke-ovens, he does raise the curtain upon his personal view that different ends in the carbonization of coal require different means—that certain vicissitudes in coke-oven working have been due in large measure to the difficulties and complications introduced by endeavouring to combine what are practically incompatibles—a good quality of coke with an important yield of illuminating gas. This describes in effect the ground of the attitude we have taken up in these columns in connection with the Coalite process, that the primary object of the process is incompatible with the primary object of the gas manufacturer, and more so to-day than it would have been a few years since. As an inspector whose functions take in questions of nuisance from works under his control, Mr. Carpenter sees another drawback to the adoption of coke-ovens in populous and congested districts such as those in which gas-works are commonly located, and without causing any serious complaint in the neighbourhood. Large bulk carbonization necessarily means that any nuisance that may arise from comparatively small charge carbonization would be considerably intensified within the period of the operations of charging and discharging. "The volumes of steam and dust arising from the "discharging and quenching of 4 to 5 tons of coke from the "ovens, together with the fumes from the charging of 6 to 8 "tons of coal for a fresh charge, would create such an amount "of nuisance to householders as to justify the greatest hesi-"tation of a sanitary authority in permitting the establish-"ment of such an industry under such conditions." We are not prepared to say that the suppression of such nuisances would not be amenable to engineering treatment—at a cost which present knowledge suggests would not be justified, under the conditions of home requirement for gas and coke. Gas undertakings are not, so far as presage enables judgment, anticipating any economic advantage from adopting a system that would cause any such nuisance, nor are they therefore likely to find any necessity to go to any expenditure in devising preventive means. The trouble in charging has been overcome in one instance by a system (described in the report), which had its origin in legal proceedings resulting from injury to cattle and to hay, in the neighbourhood of Bolton, from the brown gas evolved on charging ovens, and levelling the charges before closing the doors for coupling-up the oven again to the hydraulic main.

In his studies of the results of latter-day carbonization systems, Mr. Carpenter's thoughts have been turned, by a comparison of experiences, into a channel from which he draws much that is suggestive; and his report in this connection instances the value to workers, enamoured of the pathways they have cut out for themselves, of the independent critical observer. In the section of the report dealing with the constitution of ammoniacal liquor, he treats of the cyanogen content of the liquor under different systems of carbonization, including the Woodall-Duckham continuous system and Mr. G. R. Love's 45° inclined retorts. That is the prelude to much of interest in the carbonization section of the report, which the Carbonization Committee of the Institution (they are to be sympathized with for the rapidity of the evolution of matters for consideration) will do well to look into. However, the mass of information that has been published concerning vertical retort working—both intermittent and continuous—has made readers fully acquainted with the effects this method of carbonization has on the yield of ammonia and on the constituents of tar. But the correlation—inferred or positively settled—of certain of these effects has not been so lucidly pointed before as they are in Mr. Carpenter's report. Particularly is this so in connection with the production of cyanogen and ammonia. Indeed, something phenomenal has been traced by the Chief Inspector in the operation of the continuous system of carbonization. Dessau retort working has declared a marked reduction of 40 per cent. of cyanogen in the crude gas, and, coincidently, as might be expected (similar causes affecting), a marked reduction of naphthalene. Again, in the Guildford 45° retorts, the cyanogen compounds in the liquors are extremely low; and, while carbonic acid is present in unusual proportion, all other advantages of the vertical working are apparently derived by this system of operation, though not in all respects have they been put to the proof of absolute test. But here we have the singular point. In the article that was published in the "JOURNAL" on the Woodall-Duckham settings in June, 1907, it was stated that the volatile cyanogen was the "merest trace;" and this was with the Bourne Valley retorts. Since then, at Mr. Carpenter's desire, examination has been made into the matter in connection with the working of the latest type of retort—the one at Poole—on the continuous system. To the surprise of Messrs. Woodall and Duckham, the estimation of the cyanogen shows that as large an amount as that which is usual in ordinary high-temperature carbonization is in the scrubbed gas; and two samples of the liquor have disclosed to Mr. Carpenter that "the cyanogen contents are excep-"tionally high." Yet there is a marked reduction in naphthalene, the production of which is indicative of high temperature conditions in the retort. Why a marked reduction of naphthalene and an exceptionally high cyanogen content? Few will be prepared to hazard a hasty reply. The Chief Inspector has, indeed, scented out an interesting and unexpected point here; and the elucidation of the causes will be no less productive of interest.

As is mentioned in the report, competent investigators of the Dessau working are of opinion that the cyanogen content of ordinary coal gas is the result not of direct combination between carbon and nitrogen, but is produced at the expense of ammonia, already formed, by the latter meeting with highly incandescent carbon in its travel out of the retort. It is, however, easy to extract from the report Mr. Carpenter's view that the increased yield of ammonia in the case of the vertical retort is only partially due to the lessened amount of cyanogen in the gases leaving it, but is, in large measure, due to the lessened loss by decomposition by the existence in the Dessau retort of the comparatively cool central channel, and in the continuous retort to the fact that the products on their way from the retort do not meet with

a higher temperature than that at which they are formed. A field for further research lies before Messrs. Woodall and Duckham in connection with the additional production of ammonia in their system by the use of steam—their system, for reasons stated, being more suitable for this than the Dessau. Of course, the application of steam must necessarily be confined strictly within certain limits if the coke is not to be deteriorated; and here the question of using blue water gas is revived. Dr. Colman, in our columns, recently raised this point in connection with a discussion of certain aspects of vertical retort working; and Mr. Carpenter shows, in his report, that the vertical retort has produced conditions that may cause success to supplant the failure that met Professor Lewes's now old-time scheme for passing blue water gas into horizontal retorts. Had there then been a vertical retort available for the purpose, or had the inclined retorts at Sydenham been filled with coal to their crowns, and then the blue water gas passed in, Professor Lewes might have discovered something that would have made a part of Mr. Carpenter's present instructive report somewhat behind the times. But there was not then a vertical retort available, and the Sydenham retorts were not stuffed full of coal for a trial; and so here we are to-day considering the effects of an old idea under new conditions. The reduction of sulphur compounds in gas by carbonizing the coal in vertical retorts has also attracted Mr. Carpenter's notice; and he considers that, from this standpoint alone, the system is worth the patient investigation of the London Gas Companies.

In this article we have merely pointed to certain of the features of the report, and to some highly interesting deductions from contemporary work in carbonizing. There is much else of value in the document; but its consideration cannot be pursued this week.

Revising Provisional Order Procedure.

It is a pleasure to see that the Board of Trade are moving with the avowed intention of simplifying and lightening the expense of obtaining Provisional Orders under (*inter alia*) the Gas and Water Works Facilities Act, 1870, and the amending Act of 1873. We have only one complaint to make of the Board of Trade in connection with gas matters, and that is over the great delay that has taken place this year in the issue of the returns relating to authorized gas undertakings, but which delay we have been given to understand is due entirely to a complete remodelling of the form of the returns. It is hoped the result will vindicate those responsible for the delaying change. But, speaking generally of the department of the Board having surveillance of gas matters, we know how well, within the limits of power, the work is performed, and of the close interest that is given to the trend of events in the industry. The Board have now introduced a Bill into Parliament to repeal the provisions of the General Public Acts prescribing procedure in respect of applications for Provisional Orders, and to make the procedure subject to rules to be framed by the Board, as is the case in regard to Provisional Orders granted under the General Electric Lighting Acts. The whole intention is simplification and cheapening of process; and both simplification and cheapening all gas undertakings—not the small ones only—can do with. The formalities and channels through which the business of obtaining statutory powers by Provisional Order have to go, it cannot be disputed, is now somewhat cumbersome, and the way looks alarming with its protuberant fees and expenses. The Act (as mentioned above) under which gas undertakings move in obtaining Provisional Orders is entitled the Gas and Water Works "Facilities" Act, 1870, with the amending Act passed in 1873. But the "facilities" afforded have not been so attractive as it was imagined they would be; and if there was judgment by result only, the Act might be declared to be mistitled in its most prominent feature. If the Board, by modification, can do something to improve the conditions of affairs in this respect, so much the better; but, of course, everything will depend upon the character of the rules they formulate.

That the Board are fully aware that the Gas and Water Works Facilities Act has been, to a large extent, a failure is proved by this paragraph in the Memorandum to their new Bill: "Experience has shown that the statutory require-"ments have led to considerable inconvenience and expense, "and in the case of many small gas undertakings, have had "the effect of deterring the owners from seeking parlia-"mentary powers." The Bill in the Memorandum of which this sentence appears was ordered to be printed on the 29th ult.; and it is interesting to learn that six days previous to that date the President (Sir George Livesey) and the Council of the Society of British Gas Industries forwarded a memorial to the Right Hon. Winston S. Churchill, the President of the Board, in which this paragraph appeared: "The un-"certainty as to the result of, and the cost inseparable from, "an application for a Provisional Order deter undertakers "from approaching the Board of Trade." The acknowledgment of the Board as to the deterring conditions and the submission of the Society in the matter, being so closely dated, assume shape, on consideration, as an interesting coincidence. However, it comes as a shock to read, in the memorial of the Society, that, during the 38 years that have elapsed since the passing of the Gas and Water Works Facilities Act, only about fifty non-statutory gas undertakings have applied to the Board of Trade for statutory powers, and that there are still about 850 gas-works being carried on in the United Kingdom as non-statutory concerns. It must not, however, be imagined that 50 Orders represent the sum-total of the value to gas undertakings of the Gas and Water Works Facilities Acts. The Acts may have been ineffectual in some respects; but they have certainly had their conveniences. Some of the non-statutory Companies referred to have taken advantage of the Act more than once; and several gas undertakings with full statutory powers have found the realization of supplementary powers *viâ* the Board of Trade to be an easier and a cheaper route than applying for additional powers by a Bill. But still the figures of the Society do show that the means provided for obtaining statutory powers have not been sufficiently inviting; and those 850 gas undertakings—individually small it may be, but in the aggregate not an insignificant and negligible section of the gas industry, and not a section without good possibilities—do require some further inducement to take steps to clothe themselves with statutory privileges. There is no one who can better descant on the precious aspects of freedom in the gas industry than the President of the Society; there is no one who has fought with stronger hand for relief from an irksome bondage. But there is no one, too, who recognizes the value of security, and of a tenure not dependent upon the sufferance and goodwill of a local authority of ephemeral, or rather changing, *personnel*, and independent, too, of the foibles and self-interests of some such authorities. The security of gas undertakings dependent only upon local goodwill has no tangible prospective value; and it is from this point of view that many of the 850 non-statutory undertakings, given greater facilities, would, we imagine, gladly change their estate.

What has all this to do with the Society of British Gas Industries, who are not gas suppliers, but are the providers of plant by which gas is produced, distributed, and utilized? We fancy that, before the Society's memorial to the Board of Trade is read, this question will be asked by many. In these columns it was put forward long ago, as one of the justifications for the establishment of an organization representing the important part of the gas industry that manufactures plant and appliances, that those so identified were, in their prosperity, bound by that of the gas industry. Their ties are inalienable; hence their interest in this subject of smoothing the way for the hundreds of the smallest of gas undertakings obtaining protection which would encourage their development and public service, and for the formation of others. It is the present lack of security that debars; but an easy channel to the obtaining by such undertakings of security, under regulations by the Board, would aid home trade and employment, increase the rateable value of towns, and make more efficient the public service of such concerns. It is understood that the Society of British Gas Industries have been in communication with the Council of the Institution of Gas Engineers on this matter; and the Institution may also see advantage in throwing their weight in with the Society in assisting such a large number of gas undertakings that at present are not individually very influential to gain a stronger footing. There is a difficulty in giving the Bill of the Board unqualified support, in that it is not known what will be the character of the rules that the Board will propose to make; but there is no doubt of an earnest desire on their part to annihilate some part of the inconvenience of, and to save expense in, applying for Provisional Orders. From the 1870 Act all references to procedure are to be excised; and the rules of the Board will take their place. The clauses of the 1873 Act which provide that companies obtaining Provisional Orders are not to be exempt from the provisions

of the General Act, and for the substitution in Council of another department of the Board of Trade for the purposes of the Act, are also to be repealed. While the Board are busy on this matter, could not something be done to save some of the expense involved in the promotion of Gas Bills, by pruning and bringing up to date the Gas-Works Clauses Acts, and so enabling a greater amount of Private Gas Bill work to be done by reference?

Coal Mines (Eight Hours) Bill.

After a considerable amount of highly embellished oratory from the Ministerial benches, the second reading of the Coal Mines (Eight Hours) Bill has now been carried. The humanitarian side of the question has been during the discussion held up to veneration, and has been spoken of with long and pious face. How the stalwarts of the coal regions must be laughing up their sleeves at their pliant advocates in the House! Imagine the colliers—strong physically, in spirit, and in numbers—regarding themselves as an army of martyrs, or as sickly, downtrodden slaves, who are denied any enjoyment of the light of day. The days that are taken off by the miners to enjoy Nature's light, or for some other purpose, are no doubt at the present time being spent in the favourite haunts in mirthful appreciation of the tactful labours of the Ministerialists on their behalf. The avowed object of the Bill is this humanitarian one; but the declared objects of the miners (or those among them who are the instigators) when they originally brought forward this eight-hour question was to limit the output of coal and thus raise the wages of the miners by the higher price. They made no secret of their intention; and an inflated notion of their strength at the time, and for years after, kept safely established among them an idea that they could ride roughshod over the whole of the rest of the community. What was the intention of the miners then is their intention now; but, in the face of the world, there has to-day to be unison in the humanitarian refrain between the Miners' Federation, the Government, and their supporters. There is a little soreness within the circle of the Miners' Federation that the Government have attempted to compromise matters by deferring for five years the consummation of an eight-hour day from bank to bank. But the following of the Government have learned the value of the instalment plan of realizing complete possession; and, if the Bill once gets through the House of Lords, amendment will be easier than throwing overboard principles and partial attainment of ambitions as embodied in the measure as it now stands. On the Government side of the House in this matter, national and commercial interests are unrepresented. The Government, cowering before the power of the so-called down-trodden coal miners, have failed to realize their responsibility to the whole country.

Protection and Working of Invention.

The time-limit incorporated in the Patent and Designs Act of 1907, whereby patented articles must be manufactured in this country in sufficient quantity by Aug. 28, otherwise the patent may be revoked unless good and sufficient reason can be shown why there should not be revocation, has created a vast amount of consternation in Germany and, to a less extent, in America; and from Germany there has come a request for an extension of the time—a request that should have emanated last of all from protectionist Germany, which has profited greatly from the open door that is left by this country through which free trading can be carried on, and will still be carried on, in competition with a great part of our own productions. There is no question of imports or Free Trade involved in this new patent law; all that it says is that, in return for the protection of rights in an invention, the person or persons protected must manufacture in this country within a certain period. Otherwise the Act provides the machinery whereby the protection may be brought to an end; and the owner of a patent manufacturing abroad must then take his chance in competition with his own invention as manufactured by competing traders here.

The patent laws have been designed to stimulate home industry; but until this Act of 1907 there has been a lamentable failure in benefit to this country by the granting of a patent carrying with it no obligation as to manufacture. Since, however, the new Act has been in force, and with the time-limit facing them, many foreign owners of British patents have philosophically accepted the position, and have commenced the establishment of works in this country. Inquiry shows a widespread intention of doing this; and sites have been acquired in different parts for several manufactories—for instance, for the production of aniline dyes, pottery, cutlery, &c. It is said that no less than £200,000 has had to be invested by one group of Berlin aniline dye producers in constructing factories in England. If we can get back a small portion of the aniline dye industry to this country, it will only be a partial reversion to our birthright. One computist states that the Act is going to bring from various directions abroad an immediate investment of capital in this country of some 25 millions. If this be true, so much the better. What is happening, however, is a complete answer to those who prophesied that, through the Act, evil would most assuredly befall this country. The "evil" that is befalling us we can sit and watch with perfect equanimity. It is the sort of evil that we like.

But, as remarked, the new conditions attached to rights and monopolies, and the time-limit for operation, have created consternation, and a certain amount of anger among those who are not prepared to accept the invitation so hospitably held out to them to come among us, and manufacture as well as trade. The result is the eleventh hour request from Germany to extend the time-limit. But the British Government have no intention of doing this. Laws cannot be made in one country to be delayed or altered at the behest of another country. As a matter of fact, fresh legislation would be required to do what German manufacturers desire. Things will therefore have to remain as they are. The investment of German capital and the provision by it of employment in this country, are welcomed. It is a new experience, and far better and more equitable than the old order of things; and there will be a fair field for all comers. But the protection of this country's industries demanded that the protection offered to foreign invention should carry with it some benefit to the country. Let all fair-minded Germans remember that the tariffs of Germany do not exist here; and that competition between British and German manufacturers is permitted in this country on an equal footing—an equality that is not granted by Germany. The right to complain is really on our side.

Mr. Bywater's Paper on Refractory Material.

It would have been strange, indeed, if the Institution paper by Mr. F. J. Bywater, on "Refractory Material," had escaped the attention of the British fire-brick makers. A letter on the subject from a "Manufacturer" appeared in our last issue; and now we learn that at a well-attended meeting of the Fire Brick Section (No. 10) of the Society of British Gas Industries, held towards the end of last week, the points arising out of Mr. Bywater's paper were discussed. On that occasion, it was resolved that the members would welcome any suggestion from the Institution with regard to holding a conference on the matter. It is greatly to be hoped that this will be arranged. The idea was put forward by the President of the Institution (Mr. Thomas Glover) in the course of the discussion on the paper; so that his interest in the matter is assured. It may be conveniently added here that, at the same meeting of the Fire Brick Section, Mr. W. P. Gibbons, of Messrs. B. Gibbons, jun., Limited, was elected Chairman of the Section.

Gas Matters in Manchester.

In to-day's issue we are able to publish our customary summary of the report of the Manchester Corporation Gas Committee, and the accounts of the department, for the year to March 31, which we have received from the Superintendent, Mr. Charles Nickson. The briefest possible glance at the figures reveals the fact that the undertaking is in an extremely healthy position, and that the twelve months' record is one of continued expansion. It is true that the increase in the quantity of gas sent out from the works was not so great during the past as in the two immediately preceding years; but the very fact that the growth in output now chronicled follows closely on top of these larger increases renders it the more gratifying, though in any case the past year's gain of 3·36 per cent. would be a satisfactory one. This figure, it may be mentioned, compares with an increase in the output of just over 5 per cent. in 1907, and of nearly 6½ per cent. in 1906. The unaccounted-for gas last year—3·54 per cent.—did not vary much from the 3·14 per cent. appearing under this head in the report for the preceding twelve months. There is recorded on the present occasion a total increase in the number of consumers of 4877; while the number of prepayment meters fixed at the end

of March was 1663 greater than was the case twelve months previously. The extensive amount of work that has to be performed by the collectors in this branch of the business is seen in the fact that the sum taken from the prepayment meters, which are inspected once every five weeks, was represented by close upon 17½ million pennies, weighing nearly 156 tons. It is to be noted that about 41 per cent. of the Manchester consumers have now the free use of a cooker or griller; and the quantity of gas consumed by the cookers during the past financial year is estimated at no less than 570 million cubic feet—which is considerably more than the 426 million feet taken for running the 1741 gas-engines in use (against 1732 the previous year). In this connection, it may be pointed out that, while the quantity of gas used in engines was 2·38 per cent. more in the past financial year than in the twelve months before, the estimated consumption by the cookers was 13·09 per cent. more. But then, of course, it has to be remembered that, though the proportion of gas consumers who can make use of an engine is limited, this is not the case with cookers, which can be adopted with advantage by practically every domestic consumer. As was to be expected, the cost of coal, cannel, and oil per ton carbonized last year (11s. 4·17d.) was substantially higher than in the preceding year (9s. 11·81d.); and this increase was responsible for an addition of £35,984 to the expenditure. The result of the operations is a gross profit of £165,339, as against £167,950 in 1907; and a net profit of £116,181, compared with £120,123. The amount figuring on the present occasion as having been applied in relief of the rates is £50,000, which is £10,000 less than a year ago, and is also a smaller sum than will be probably appropriated during the present year. While the income of the department went up during the past twelve months from £730,902 to £782,690, the expenditure (owing, of course, mainly to the heavy increase in the cost per ton of coal, oil, &c., and to the extra quantity used) also rose from £564,304 to £618,702. For the purposes of the Committee's apportionment, there has been transferred from the reserve fund and added to the net profit the sum of £7359.

The Deputation Question Again.

An amount of stir which seems to be altogether out of proportion to the subject that gave rise to it, has been created at Burton-upon-Trent; but then, of course, it is a fact that the matter responsible for all the agitation is one that peculiarly lends itself to the sort of discussion that is dear to the soul of some town councillors and ratepayers. In many places and at many times we have read debates in which scientific meetings (including, on occasion, those of the representative body of the gas industry) have been solemnly characterized as "picnics;" while deputations of all kinds have frequently had to submit to even less complimentary designations. In the case of the scientific meetings, it is usually a proposal to pay the expenses of the particular officials to whom the gatherings may appeal that gives rise to these remarks; while with regard to deputations, also, care for the ratepayers' pockets is claimed to be responsible for any objection that may be raised. This has been the case at Burton, where a few members of the Council and apparently a section of the ratepayers have opposed the spending of something like £50 or £100 on sending a deputation to Germany to inspect the installations of vertical retorts in operation there, prior to their adoption probably at Burton, in connection with a gas-works reconstruction scheme which it is anticipated will cost between £20,000 and £30,000. The suggestion—which, be it noted, was based on the strong advice of the Council's Consulting Engineer, Mr. J. Ferguson Bell—was that a small deputation should spend about six days in travelling to and from Burton and visiting the different gas-works in Berlin and Cologne; and this was described by one of the ratepayers as a "little holiday jaunt." It really seems as if fault is being found with the fact that some of the members of the deputation may enjoy the sea-trip, though why complaint should be made of this, if at the same time the ratepayers' interests are being served by the transaction of the business for which the journey is undertaken, it is difficult to understand. And that it is in the interests of the ratepayers that the deputation should, as far as practicable, make themselves acquainted with the process on which it is proposed to spend such a large sum of money at Burton, can hardly be seriously questioned. In so short a time, it is, of course, impossible that the visitors can make themselves fully acquainted with the vertical retort process; but they will at any rate learn something, and this something they should afterwards be able to turn to good account. In making the fullest personal inquiries possible into any process that it is proposed shall be adopted for the gas-works, the Committee are only doing as they would do if the money involved was their own instead of that of the town. There seems, in face of this agitation, to be much truth in the saying of Mr. Haldane, which was quoted by one councillor, that "an ideal public man should possess the patience of Job, the temper of a saint, and the skin of a rhinoceros."

Daylight Saving Bill.

This Bill appears to be in a somewhat derelict position; and at the moment, until there is further explanation from the Government, they seem to have been guilty of allowing the time of a Select Committee, and of a number of men whose business and other engagements are of as great importance as those of a Cabinet Minister, to be frivolously wasted. According to Mr. Winston Churchill, he has arranged for the whole subject to be carefully examined by the Board of Trade in consultation with representatives of trade, labour, and transport interests. He gave this information in the course of a cautious reply to a question by Sir E. Sassoon, who was the Chairman of the Daylight Saving Bill Committee; and the reply evinced an undecided mind on the part of the right honourable gentleman, as to whether the advantages offered by the Bill are not more apparent on first blush than real on deeper consideration. But he refused to express any positive opinion until his departmental inquiry has been made. Only two days later, however, the Prime Minister, with laconic directness replied to an interrogator: "No, Sir; the Government have no intention of giving facilities for the passing of the Daylight Saving Bill." There was no indecision here. But why this emphatic announcement in view of Mr. Churchill's statement? Was Mr. Asquith's reply a rebuff to the President of the Board of Trade for projecting a second inquiry into a subject that Sir E. Sassoon's Committee consider has been sufficiently investigated? Does the reply mean that the Board of Trade inquiry will be stopped? And does it mean that the Government have determined to have nothing to do with the Bill? It is certain that one thing it does mean is that the Bill is shelved for this session. Vendors of artificial illuminating agents will breathe freely again, if the Bill has hitherto had any bad effect upon them.

Legislating against Strikes in New Zealand.

Striking will become an expensive luxury in New Zealand, in the event of the passing into law of a Bill which was introduced into the House of Representatives last week. The measure—the title of which is the Industrial Conciliation and Arbitration Act Amendment Bill—will make strikes and lock-outs acts to the committal of which heavy monetary penalties will attach; and the longer the dispute, the greater will be the penalty. For instance, cabled reports show that under the Bill every worker who is a party to a strike will be liable to a fine of £10, and £1 additional for every week the cessation of work continues; while the forfeit for a lock-out is £200, with a further £50 a week during its continuance. The section of the Amendment Act of 1905, however, which provided as a last resort for the imprisonment of strikers, will be repealed; but the payment of any fines inflicted under the new provisions will be secured, if necessary, by deduction from wages (when earned) by the employers. The cost of inciting, aiding, or abetting a strike or lock-out will be £10, if the transgressor be an individual worker; but if it be a Trade Union, employer, or any person other than a worker, the fine will be £200. And in the case of Unions, this is not all; for there is a clause providing that any Union convicted of aiding, inciting, or instigating a strike by any of their members, shall have their registration suspended for a period not exceeding three years. The Bill contains special provisions with regard to workers in industries the stoppage of which would involve danger to the health or safety of the public—such as gas companies, railway companies, bakers, &c.—or cause damage to the property of employers. In these cases, men who strike without having given at least three weeks' previous notice of their intention so to do, will render themselves liable to a fine of £10 or three months' imprisonment. A "strike" after three weeks' notice would hardly be likely to commend itself as a hopeful undertaking; so that this clause should do much to safeguard the interests of the public. The

penalty for a breach of an arbitration award has been fixed at £100 in the case of a Union or employer, and £10 in the case of a worker. The Bill will abolish the existing Conciliation Boards, and establish in their place Councils of Conciliation, consisting of a magistrate and two assessors, who must be workers or employers in the particular industry in which the dispute may have arisen. Should a settlement not be arrived at, the Council may state a case for the Arbitration Court, which will have added to it assessors engaged in the industry concerned, but not parties to the dispute. The Court will be empowered to fix one wage for workers of average skill and energy (to be termed a "needs" wage) and another (called an "exertion" wage) for work done above this standard. It is not likely that the terms of so stringent a measure as this is will meet with universal approval, and the need for any such precautions against industrial dislocations is to be regretted; but even a peace that is secured by the fear of pains and penalties—though it is not the kind of peace one would wish to see—is less likely to lead to disaster than open warfare.

PERSONAL.

Mr. CECIL H. ROBERTS, one of the Assistants to Mr. H. Ashton Hill, the Engineer of the South Staffordshire Water Company, has been appointed Water Engineer to the Southampton Corporation, in succession to Mr. W. Matthews.

Mr. T. LINDSAY, who has been Meter Inspector in the employment of the Corporation of Gourock for many years, has been appointed Manager of the Corporation gas undertaking, to fill the vacancy caused by the death of Mr. John M'Gilchrist.

The report submitted by the Lighting Committee at last Wednesday's meeting of the Bangor City Council made some reference to the retirement of Mr. JOHN SMITH, who has been Manager of the Gas-Works for 34 years, and who will still be available to render service to the Corporation as Consulting Engineer. Mr. Bayne remarked that the town had found in Mr. Smith an experienced and faithful Gas Manager. Mr. Roberts, as a member of the Lighting Committee since the incorporation of the town, spoke in warm terms of Mr. Smith's valuable services, to which Alderman Henry Lewis also bore an eloquent testimony, and moved a special resolution of appreciation. This was carried amid cheers.

Some of our readers are probably aware that Mr. T. H. Martin, the Engineer and Manager of the Barnet District Gas and Water Company, will shortly retire. We learn that his successor will be Mr. F. J. BANCROFT, the Gas and Water Engineer of the Hull Corporation. Mr. Bancroft is not a stranger to Barnet, for he held the position of Assistant-Engineer there prior to going to Hull about twelve years ago. He was trained in engineering by his father—a Past-President of the Civil and Mechanical Engineers' Society and for many years on the engineering staff of the Great Northern Railway Company—and commenced his career in the Surveyor's Department of the Vestry of St. Mary's, Islington. He then successively served the Finchley and Edmonton Local Boards in the capacity of Assistant-Engineer, and subsequently obtained the appointment at Barnet. In the midst of all these activities, he found time to take his degree as Bachelor of Science at the University of London. He is an associate member of the Institution of Civil Engineers, and a member of the Institutions of Gas Engineers and Mechanical Engineers; and in 1904 he was President of the Association of Water Engineers. Since he has been at Hull, Mr. Bancroft has entirely reorganized the Water Department, with the result that the third port of the kingdom can boast of one of the most thoroughly successful undertakings of the kind in the country. To considerable power as an administrator he adds a most agreeable disposition, which has secured the high esteem of a large number of friends, who, while pleased with his advancement in his profession, regret the severance of personal association with him which that advancement will necessarily entail.

At the Barry Hotel, last Friday evening, Mr. F. M. Harris, formerly Gas Engineer to the Urban District Council, and Mrs. Harris, were presented by members of the Barry Local Government Officers' Association with appropriate gifts, as a mark of esteem and regard.

The Council of the Society of Engineers have arranged for an amalgamation with the Civil and Mechanical Engineers' Society. The Secretary of the first-named Society (Mr. A. S. E. Ackermann, B.Sc.), holds a similar position in the second; and it was through his intervention that negotiations were opened with representatives of the two bodies.

The list of applications for patents appearing elsewhere today is interesting, if for nothing else, because of the fact that Mr. Thomas Parker (of "Coalite" fame) is entered for no less than six separate patents, dated the 3rd inst.—five for the "Destructive Distillation of Coal" and the other one for "Lifting Apparatus." The process with which Mr. Parker's name is associated seems to require a lot of protecting and perfecting.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 128.)

THE Stock Exchange has had a curious and eventful week. A genuine surprise, which nobody appears to have had an inkling of, was in store for it to open with on Monday morning, in the shape of the Irish Land issue. The low price produced a rush of "stags" and so engrossed general attention that Consols and other choice articles in the gilt-edged market were left severely alone, and the general effect was adverse to the rest. On Monday, Consols fell $\frac{5}{16}$, and Home Rails were a very weak spot. On Tuesday, Consols were still languishing; but other markets were not so bad. A better turn was taken on Wednesday. It was rumoured that the Irish Loan stags would be disappointed, and some good investment buying in the old lines was effected, Consols advancing $\frac{3}{16}$. But nothing could keep the Railways up; they seemed to have no spring in them at all. With the exception of this market, things on Thursday were generally pretty steady. Friday was a victim to a run of realizations, which effectually took the edge off everything that had begun to sharpen up. Saturday was so quiet that most markets had no chance of recovering; but Consols managed to score an exceptional rise of $\frac{1}{16}$. The Money Market was strongly influenced by the Irish Land issue, the applications for which were on so huge a scale that a very large sum of money was withdrawn for deposits on application. Rates thus stiffened for some days; but they eased off when the tension was relieved. Business in the Gas Market was, on the whole, rather quieter, and was not spread over many issues. In fact, putting aside the dealings in the leading undertaking, the aggregate of all the rest bulked very small. In Gaslight and Coke, the ordinary was well supported at steady prices, and the quotation was put up half-a-point. Transactions ranged from 97¼ to 98. Little was done in the secured issues; the maximum marking 88½, the preference from 107½ to 108¾, and the debenture 84. South Metropolitan was inactive, but very firm, at the old figures—viz., 118½ to 119½. The debenture realized 85⅛ and 85$\frac{15}{16}$. Commercials were very quiet, with transactions in the 4 per cent. at from 106 to 108, and one in the debenture at 82. The Suburban and Provincial Companies were quiet even for them. Brighton original was done at 208, and South Suburban at 116½. On the local Exchange, Sheffield was put down a point. The Continental Companies were below par in activity, but steady and unchanged in price. Dealings in Imperial ranged from 179½ to 180¾, Union changed hands at 112 and 113½, ditto preference at 138, European fully-paid at 23¾, and ditto part-paid at 17⅛ and 17¼. Among the undertakings of the remoter world, Buenos Ayres was done at 11⅛, Primitiva at 6½ and 6$\frac{3}{16}$, ditto preference at from 5$\frac{1}{16}$ to 5⅛, River Plate at from 13¼ to 13½, and Oriental at 141½ and 142½.

ELECTRICITY SUPPLY MEMORANDA.

Idiosyncrasies of Municipal Electricity Management—Public Lighting—Electricity Load Factor v. Rate Load Factor—A Mass of Unfairness—The Pace at Brighton.

ANYONE who wants argument against municipal trading in electricity should read the discussion that took place on the public lighting at the meeting of the Tunbridge Wells Town Council on the 1st inst., an epitome of which was published in our columns last week. There we have, in respect of one phase of the question, the truth brought out in all its nakedness. The public lighting must be had for the electricity station no matter how much higher the price than the Gas Company offer to charge, no matter how much lower the efficiency of the electric lamps. And why? Because of that precious load-factor that the public lighting is supposed to give to the electricity undertaking, and because there is so much capital invested in it that a revenue higher than the Gas Company would derive from the public lighting must, it is thought, go into the coffers of the Electricity Department. "But consider the interests of the ratepayers," quoth the economist representative of the people. "Fiddlesticks! What care we for public interests? Consider our load factor," is the callous reply of a majority—composed largely of members of the Electricity Committee—on the Tunbridge Wells Town Council. It would be a good thing if ratepayers of Tunbridge Wells, and of many other towns too, could murder that hypothetical good Samaritan the public lighting load-factor. It is worshipped much beyond its merit. The town councillors who talk so glibly of it, do not understand it, and certainly do not remember the point of its incidence; they only think of the public lamps as long-hour consumers of electricity and wasters of the public funds when the ratepayers are asleep. The peak-load of the electricity station is when private lighting is at its height; and on top of this comes the street lighting, involving larger capital outlay and running expenses. There are many electricity stations to-day that, if they had never had loaded upon them the expenses involved in street lighting would have been in a more profitable position, and could have been run more economically, to the advantage of the private consumers.

The Electricity Committee at Tunbridge Wells are charging at the present time, and until the end of this year, £3 19s. 6d. per electric incandescent lamp; they are going to reduce the charge

to £3 3s. in the sweet by-and-by. The Gas Company are willing to undertake the whole of the lighting of the existing gas-lamps, on a three years' agreement, at £2 15s. each, or the whole of the existing lamps on a year's agreement at £2 17s. 6d., or, if a proposed reduction to 414 gas-lamps is carried out, at £3 12s. 6d. each. It stands on record that the Tunbridge Wells Town Council have bound the ratepayers to this price of £3 12s. 6d. for gas-lamps (against £2 15s.), and a charge of £3 19s. 6d. and later £3 3s. for electric lamps (also against the £2 15s.), and all for the sake of the electricity station. So that it comes to this, that a number of lamps are to be taken from a private Company, who are large ratepayers, and willing to supply at £2 15s., in order that the Electricity Department may have less efficient street lamps running through the night, largely during the sleeping hours of the ratepayers of the town, at £3 19s. 6d., and later at £3 3s. Waste, waste, waste! Municipal trading is causing local government to run mad. In this particular instance, it is all in the interests of the "load-factor" of the electric lighting station; but that particular load-factor is not more interesting in the eyes of the ratepayers than another member of the same family. This is the rate-load factor; and as the electricity load-factor is (so the Electricity Committee think) made better through the public lighting, so the rate-load factor becomes worse for those who have to bear it. Let ratepayers—more especially those who are not electricity consumers—consider this question from the standpoint of the rate-load factor; and they will not be long in making clear to their representatives (who by their acts show that they do not care a fig for the interests of their constituents) who are really the masters in the affairs of the town.

This street lighting question, where fair competition between a municipal electricity committee and a gas company is not allowed by the council, is embedded in a vast amount of unfairness. In the first place, Tunbridge Wells is an example of several other places, in that the public lighting is under the charge of the Electricity Supply Committee. A majority of the Town Council are quick-change resolutionists. One day when wisdom dominated, they decided to transfer the public lighting from the Electricity Committee to an independent Committee; but this decision was come to in the absence of the Mayor and Chairman of the Electricity Committee. Not many days after, the members of the Council who had dared to do this thing were quailing under the eye of an irate Mayor; and at his command they revoked their sensible resolution. Further result: An agreement to put additional street lighting in the hands of the Electricity Committee, and to compel the Gas Company to quote a higher price for the lamps that the Electricity-Committee-dominated Council chose to leave in their hands. For allowing this domination, the ratepayers have to pay. That is the first piece of unfairness. The next is that members of the Council who are shareholders in a Gas Company are not allowed to vote on these public lighting questions. But members of Electricity Committees are, though they are both sellers and buyers. The difference, of course, is that the gas shareholders have money invested in the gas undertaking; the members of the Electricity Committee have no personal money invested in the electricity undertaking. But they secure an unfair advantage in being able to vote for their schemes in the interests of the electricity undertaking and against (in this instance) the interests of the ratepayers, while the councillor gas shareholders are unable to throw their weight in the balance against them. The ratepayers represented by the latter are thus unrepresented in this matter of public lighting. It is really a serious anomaly that municipal trading has in this way introduced into local government, and by it prejudiced interest has gained supremacy over prudent administration. There is no getting away from it; the fact is clear. But while shareholders in gas companies who are councillors are advised that they must not vote on the question of public lighting, we know of nothing that prevents them from expressing their views on the question in the Council Chamber. But there are some councillor gas shareholders who are afraid to even open their mouths while the public lighting is under discussion. Perhaps the Gas Companies' Protection Association can stiffen their backs and loosen their tongues by saying whether or not our view of the position is the correct one.

Another feature of the unfairness in this competition between municipal electricity supply and company gas supply for public lighting is that, as a rule, the electricity cables are only laid where it is expected the fattest business is to be secured, and that part is usually in the centre of the town. The tendency of the encroachments of electricity on the public lighting business of gas companies is therefore to drive the street gas lighting from the more lucrative centre to the portions of the area where the lamps are more scattered and (on the borders of the lighting district) isolated. The average advantage to the gas suppliers is in this way much reduced; while the average capital and general charges involved in the public lighting are increased. Municipal authorities, under these circumstances, cannot be surprised if, as gas suppliers are deprived of the central lighting, they find it necessary to increase the charges for the lamps that remain. Hence the difference between the £3 12s. 6d. per lamp per annum quoted by the Tunbridge Wells Gas Company for a reduced number of lamps and the £2 15s. for a three years' contract for the whole of the existing lamps. Gas companies will not be disposed to do the remnant public lighting at a loss, even if they do lose the whole of it through refusing to be forced back to a profitless state in this business by the application of the electric screw. But the results of this will be found in the future in the increased costs of public lighting compared with what might have been. The Tunbridge Wells Gas Company offered a considerable saving per annum to the Town Council. That saving has been rejected; and added to this loss to the ratepayers is the additional price they have to pay for electricity. If the Electricity-Committee-ridden Town Council do not have an uncomfortable time over this, the ratepayers of the town will show an ignorance of, or a blindness to, their own interests. The public lighting is regarded as a good advertisement by the Electricity Committee. A prominent advertisement maintained in the local papers by the Gas Company, showing what is being lost per annum by the rejection of their lowest offer, will keep before the eyes of the ratepayers the cost to them of the public lighting advertisement.

The Brighton Corporation electricity undertaking refuses to be speeded-up in its business; and if it were not for considerable economies in expenditure, the financial condition of the undertaking, at the close of its year's working in March last, would have been almost as bad as in the preceding year. It seems fated that the municipal trading enterprises of Brighton shall have a mournful issue. Last year the electricity undertaking managed to make a loss of £3658, the year before of £10,233, and the year before that of £976, or in the three years a total of £14,867. The deficit in the past year has been made good from the reserve fund, which now stands at less than 1 per cent. on the capital expenditure of £774,474. The monotonously slow rate at which the business is expanding is shown by a very few figures. The number of units of electricity sold in 1905-6 was 8,000,200; and last year, 8,002,376—an increase in two years of just over 2000 units, including traction supply. The average number of units sold per 8-candle power lamp in the two periods was 27·5 and 25·5; and the number of consumers has risen at the following rate: 4387 in 1905-6, 4500 in 1906-7, and 4525 in 1907-8. Such an increase as 25 in twelve months is snail-like progress. What is the reason? Is it satisfaction with incandescent gas lighting?

FIRE-CLAY EXHIBITS AT SHEPHERD'S BUSH.

In addition to the fire-clay exhibits at the Franco-British Exhibition of Messrs. Mobberley and Perry and Messrs. B. Gibbons, jun., and Messrs. Gibbons Bros., which have already been noticed in the "Journal," there are three others of a somewhat similar character in the Machinery Hall which call for brief notice. The stands referred to—which are situated in close proximity to one another—are those of the Glenboig Union Fire Clay Company, Limited, Messrs. George K. Harrison, Limited, of Stourbridge, and Messrs. Gregory, Reddish, and Co., Limited, of Deepcar, Sheffield.

The Glenboig Union Fire-Clay Company show both inclined and vertical retorts. The former are specimens of the Edinburgh retort; and the verticals represent what are at present being erected at St. Helens. It need hardly be mentioned that the firm supply all descriptions of gas-retorts, on a very large scale; their customers including the leading gas-works at home and abroad. Their retorts and blocks, they point out, possess in a very high degree the quality of not melting or splitting when subjected to high heats and sudden changes of temperature. Messrs. George K. Harrison exhibit retorts, and bricks and blocks of all shapes and sizes for retort-setting, glass-furnaces, &c. In fact, the wide variation in the uses to which their clay may be put is aptly demonstrated by the close proximity of some small brick foot-warmers to the imposing gas-retorts which stand on end facing the visitors. Messrs. Gregory, Reddish, and Co. show their "Gregory" brand silica bricks, which are used for gas-works and all purposes where great heat is required to be kept up continuously. There are also to be seen samples of the firm's fire-bricks, which, of course, are made in all shapes and sizes. On the stand are samples of the ganister from which the silica brick is made, and also a sample of lump clay.

A Gas-Engine Manual.—We have received from Messrs. Percival Marshall and Co., of Poppin's Court, E.C., "The Gas-Engine Manual," by Mr. W. A. Tookey. The name of the author may be remembered by some of our readers in connection with a little book on gas-engines which he produced some five years ago. The present work is of a more comprehensive character, and is intended to be of service to the practical engineer by forming a stepping-stone to the more scientific treatises on the subject. The book is confined entirely to the study of the working principles of the ordinary industrial gas-engine built on the Otto or "four-stroke" cycle, governed by "hit-and-miss." The scheme upon which it has been written is to first examine the four strokes of the Otto cycle in the order in which they occur; studying the conditions that affect each of these operations, and thus ascertaining the proper methods to adopt in erecting an engine to ensure the best results in daily work. A special feature of the book is the series of indicator diagrams, most of which are reproduced from actual cards taken by the author. They will be found to illustrate the application of the principles enunciated in the earlier chapters of each section of the book. The subject-matter is preceded by an interesting history of the gas-engine. The price of the "Manual" is 3s. 6d. net.

A SIMPLE DISCOVERY INCREASES LIGHTING EFFICIENCY.

THE recent advances that have been made in electric incandescent lamps still leave incandescent gas-burners far ahead in economy and efficiency; but it must be confessed that those advances have narrowed, and to an appreciable degree, the relative positions of the competitors, in respect of ordinary illumination. That being so, every means that presents itself for recovering part of the difference lost will be welcomed; and therefore to a simple device that is before us, and which we have proved by photometrical tests does enhance the efficiency of ordinary incandescent gas-burners, welcome is given. Though the invention is a simple one, we think, before this article is finished, it will be shown to satisfaction that the theoretical reasoning that gave it birth is proved sound by practical result. The invention consists of (for vertical mantles) a solid cone-shaped body of steatite clay, circular in section, and of studied irregular diameter (as shown in the illustration) to secure certain effects; the largest bulbous part being at the base, with a constriction above, and slightly bulbous again near the top before tapering off. This shape has been found to be the most effective for the purpose of, primarily, intensifying the incandescence of mantles. The specification of the patent (which is held by Mr. L. H. Eady and Mr. E. W. H. Eady, of Southampton, and Mr. Joseph Cash, of Brighton) is a comprehensive one. It does not limit the patentees either to shape or material; but it covers the use in a mantle of a solid heat-retaining body of any suitable substance. There will be something to be said presently respecting the use of such solid bodies in inverted mantles; but there will be less complication, in dealing with principles and result, by confining ourselves, in the first place, to the use of the invention in ordinary upright mantles. Before proceeding, however, it should be said that the size and shape of the solid body used depend on the size and the shape of the mantle to be employed, if the highest efficiency is desired.

First with regard to the fitting of the solid conical body inside the mantle. There is a hole running centrally through the body, of a diameter sufficient for passing through an ordinary mantle-supporting prop; and the bottom part of the lower and largest bulbous portion of the solid body is so curved that, when seated on the cap of the burner, it offers no check to the combustion of the gas. Having made an investigation of the use of this cone, it is preferred to deal with it from our own observations, amalgamating, where convenient, experiences of the inventors. There has been much said, as the result of research into incandescent gas lighting, as to the importance of flame temperature and flame volume in securing the greatest efficiency from an incandescent burner. Regarding the matter from the theoretical standpoint, this simple device it is clear must affect both flame temperature and the volume of flame brought into contact with the mantle; and, furthermore, the contraction of the space inside the mantle and the shape of the cone must give impetus, though perhaps in limited measure, to the travel of the flame over the surface of the mantle. The effect of the increase in velocity is, of course, well known, on a larger scale, in connection with self-intensifying lamps; and this is a point of which we will not make too much. But now put a cone on to a mantle prop, light the bunsen flame, and it is seen that the cone quickly becomes heated up to a white temperature. Here we have heat being conserved; and this white hot body in the centre of the flame must unquestionably enhance the value of the flame for the special function that it has to perform in the incandescing of the mantle. The introduction, too, of this solid body produces an annular space and directs a larger volume of the flame on to the mantle; and the mantle—providing that cone and mantle are fitted for each other—is well filled with the flame to the very top. A hollow body suspended within the mantle would not have the same effect. As a matter of fact, it would only serve as a channel for the escape of flame and heat, and so would do more harm than good. This Mr. Cash found in his early experiments, before the suggestion of the solid body was made to him by Mr. Eady. Much the same thing was found when the idea occurred to someone years ago that one mantle suspended within a larger one would give a very greatly increased illumination. To the eye there was indeed a greater brilliance caused by the greater body of incandescence. But the photometer proved it to be largely an optical illusion; for what one mantle gained the other lost—there was, as it were, no storage of heat as there is with this solid body, and the flame was broken up by the introduction of the smaller inner mantle. In short, the game was not worth the candle. An important point is to so adjust in the mantle the position of the cone, that the bottom bulb at the point of greatest diameter is in alignment with the part of the mantle from which the greatest illuminating efficiency should proceed, which is, after the mantle has accommodated itself to the burner, at the point of the mantle's greatest diameter. This adjustment can be easily made. If, too, a mantle is used of more than ordinary length, the cone can be accommodated to it by breaking the prop and introducing an additional length of stem making joint in the central hole of the cone, so as to lengthen the support to the requisite extent.

In the patent specification these words are noticed: "It is found that with bodies such as described, the illuminating power given by the mantle is increased, or the same illuminating power is obtained with a reduced quantity of gas." Numbers of tests that have been made at different times, and under different conditions, bear this out. Take one set of tests with a Kern burner and mantle. Without the cone (using 4 cubic feet of 15½-candle gas), the average result was 63 candles. Taking the same burner and mantle with the cone (the pressure and consumption being also the same), the average of a number of readings was 76 candles. Reversing the process, and reducing the consumption until the light (using the cone) was equal to 63 candles, it was found that the consumption was lowered to 3·6 cubic feet. This means that the cone gives in this particular set of tests 20 per cent. increase of illuminating power, or 10 per cent. reduction in consumption of gas. Another set of tests with a No. 4 Kern burner and mantle gave an average of 58 candles without the cone, and an average of 81 candles with it—the consumption being maintained at 4·2 cubic feet. Our own photometrical readings, using a No. 4 burner and the same mantle in each case, showed a full 20 per cent. increase of illuminating power by the use of the cone. By the way, it might be pointed out that the readings should not be taken until the cone has become heated up. Some street lamp tests, made *in situ* with a portable photometer fitted with a Simmance-Ababy "Flicker," showed an average illuminating power for a number of burners without the cone of 43 candles, and for a number with the cone of 67 candles. This average was obtained without discarding the extreme maximum and minimum readings. While on this subject, too, it may be mentioned that at Southampton there has been an extended test (under the supervision of the Borough Engineer) of burners fitted with the cone. There was allocated for the purpose a road continuous with one lighted by Osram lamps; and the result has been so satisfactory that an order has been given to fit up 120 more lamps in one district. Upon the outcome will depend future extension.

In addition to the gain in illuminating power, experience has disclosed another advantage; and this is an advantage the importance of which was not so apparent to the patentees at the outset as it is now. The benefit lies in the direction of the preservation of mantles; and it is produced in a double way. It is noticeable that—in street lamps especially—mantles suspended from props have a tendency to sway through the disturbing action of the flame. The restriction of the pathway of the flame by the use of the cone appears to have the tendency of steadying, and (so to speak) stiffening, the flame by its contraction; and this gives support to the mantle, and keeps it from oscillating, so helping in its preservation. But that is not the most interesting point. With an ordinary incandescent burner, the mantle to some extent suffers physical violence by the rapid cooling and contraction to which it is exposed (particularly in street-lamps) by the sudden extinguishing of the flame. Light a burner fitted with one of these cones; and, when the cone has become well incandescent, extinguish the flame. It is interesting to watch the gradual disappearance of the incandescence, and consequently the gradual cooling down of the cone. The result of this is that the heated cone affords the mantle the protection of slow cooling, instead of, as is ordinarily the case, the mantle being subject to rapid cooling and contraction, and so hastening destruction. This we regard as an important point, and more especially in street lamps where the mantles are exposed to severe changes of temperature. It will be interesting to get some comparative experience on this head over a period that will cover the extremes of variation in atmospherical condition; but in connection with the lamps in one road in Brighton (remember this is a breezy seaside town), with the cone fitted, the average mantle renewal over three months has been 1·6 per lamp, as against an average of 3·8 mantles in an equal number of lamps without the cone—in other words, a saving of more than half the mantles previously necessary.

The system can also be applied to inverted burners. In this case a pear-shaped cone is used, with the apex in the burner nozzle. But with inverted mantles, the results have not been so certain as has been the case with the vertical mantles; and this is due to the irregular shapes assumed by inverted mantles in use. The inventors have introduced an ingenious arrangement whereby the cones can be adjusted to meet these irregular shapes; but when regular shaped mantles can be depended upon, so as to get a definite and equal space between the cone and the mantle all round, then the advantage is on corresponding lines to that obtained with vertical burners.

We have here a simple but useful improvement. A long time has passed in the history of incandescent gas lighting before its discovery. But the old truth comes up again, that seekers for advance rather look for it in complexity, and not in simplicity. To that is due much delay.

THE CARBONIZING CHAMBERS AT THE HAMBURG GAS-WORKS.

By R. Lessing, Ph.D., F.C.S.

The revolutionary changes in the principles of carbonizing coal for the manufacture of illuminating gas, which set in at the commencement of the present century, following upon 100 years' steady progress by the less exciting methods of evolution, make it rather difficult for the earnest student of the art and science of gas-making to follow the trend of invention along its windings and manifold branches, and to keep abreast of all important innovations following each other in rapid succession. This rapidity of progress renders it necessary to closely watch the work done, and to report progress as frequently as possible and at any stage of perfection of new ventures.

The visit of the Institution of Gas Engineers to Berlin stood clearly under the sign of the vertical retort; and it is not too much to say that the bench of verticals at the Imperial Continental Association's Oberspree works was the *pièce de résistance* of everything seen. What struck the visitors most was, I think, the unexpected perfection of the plant; its smooth running clearly indicating that the system had honourably emerged from the experimental stage. This was perhaps not so much due to the high flights of inventive genius bent on creating a masterpiece, but rather to the thoroughness and perseverance in perfecting every little detail in construction and manipulation. And this achievement, again, was only possible by calling to aid a small army of helpers for the working out of all the many scientific, technical, economic, and financial problems concerned—a system much cherished by German captains of industry, and one well worth considering on this side of the Channel, where many good attempts in the industrial world fail or experience undeserved set-backs, on account of their inaugurators, in sportsmanlike spirit, it is true, choosing to fight singlehanded.

That the principle adopted by the German Continental Gas Company and its powerful group allows of the most rapid progress possible, and does not permit their workers to rest on their laurels, was evident from the trials made with vertical chambers so early after success with their ordinary retort was achieved. Experimental settings of these large retorts have been erected both at Dessau and Mariendorf (as referred to in the "Journal" for June 30, p. 919). This system, as compared with the ordinary Dessau retorts, shows so far disadvantages only—viz., the bulkier mechanical appliances which necessitate hydraulic moving devices and cause increased expansion, the increase by 10 per cent. of the fuel required, larger fire-clay units, &c. It seems, however, that the designers expect certain advantages from this system; and no doubt their skill and experience will help them to master the details that at present hamper the carrying out of the principle in a desired manner. The tendency to increase the carbonizing space seems to indicate that Dr. Bueb views this problem now with more sympathy than he did some time ago, in his criticism of the Munich chambers.*

From a desire to obtain first-hand information about these new rivals of the vertical retort, the writer journeyed to Hamburg after the conclusion of the Berlin visit, during which he had the honour of accompanying the members of the Institution of Gas Engineers.

The readers of the "Journal" have been kept well informed about this system of carbonizing. Quite recently Herr Ries, the Manager of the Munich Gas-Works, the designer of the chambers, gave details of the construction and working of his Munich plant in his communication to the Association of German Gas and Water Engineers, as reported in the "Journal" for June 23 and 30 (pp. 848 and 927). Herr Ries, in his paper, referred to the new Hamburg installation as being the largest in existence; completion of the new Munich plant of still higher capacity being only expected during next winter—in fact, the working of the original chambers at Munich yielded such promising results, that the Hamburg authorities boldly decided to have the chamber capacity nearly doubled.

The installation in the Grasbrook works, situated in the centre of the Hamburg "Freihafen" district, and next door to the emigrant quay of the Hamburg-America Line, had been, at the time of inspection (June 23), only three weeks in operation. Considering the short period of actual working, and in view of the fact that the whole works are at the present moment undergoing a complete reconstruction—a large number of ferro-concrete piles were heaped up, to serve as the foundation for a new gasholder—it is impossible to give actual working results; and the writer has to apologize for the incompleteness from which a description must, under the circumstances, suffer. A feature which strikes the visitor first on his approach is the complete absence of the retort-house. The plant presents itself as a compact and very massive block, giving the appearance of very high coke-ovens. The total height from the ground to the roof of the bunkers is about 65 feet. It consists of ten settings of three chambers each. The carbonizing chambers are placed upon the regenerators at an angle of about 36°, and have a total length of 24·6 feet, corresponding to 21·5 feet on the horizontal; the height of the vertical cross section is 9·2 feet, corresponding to 7·4 feet distance between the chamber bottom and the arch.

The width of the two outside chambers is 1·8 feet each, while the middle chamber is 2 feet wide, allowing the more concentrated heat in the centre of each furnace to act on a thicker mass of coal. Each chamber is provided with two ascension pipes—a 10-inch one on the charging (back) end of the chamber, which carries the bulk of the gas; while a 6-inch pipe at the discharging (lower) end acts as a pressure equalizer. The pressure in the chamber is from 1 inch to 1·5 inches; ¾ inch being maintained in the hydraulic main. On the charging side of the chambers, two doors are provided; the charging door, 2 5 feet high by 1·3 feet wide, just under the top arch of the chamber, and the clearing door, 1·8 feet high by 1·3 feet wide, on the bottom of the chamber. The width of all doors is the same on all three chambers of one setting.

The charging is effected by gravity from suspended hoppers, which are filled from bunkers on the top of the building; the coal being carried into them by an elevator. The time taken for filling one chamber is about 35 seconds. Clearing doors are used for the inspection of the discharged chambers; and an electrically driven pusher, similar to those employed on coke-ovens (but, of course, working on an incline) is used for clearing out any coke that might adhere to the bottom of the chamber.

The mechanical appliances on the discharging side are of a novel and very interesting kind. The doors are of rather unusual dimensions, having a height of 9·2 feet—the centre door being 2 feet wide, and the two others 1·8 feet wide. The doors are suspended on the top on horizontal hinges. They are pulled up after loosening the eccentrics, by means of chains hooked on to two rings on the lower part of each door; the chains being worked from a winch on the movable coke-quenching chamber. The average charge of a setting being 17·5 tons, it is obvious that unusually large quantities of coke have to be dealt with. The solution of the discharging and quenching problem was a very happy one. On opening the door, the coke drops on a movable shoot, and from there, through the quenching chamber, into a De Brouwer conveyor. The quenching arrangement consists of a water-jacketed steel chamber formed as a chimney for the leading away of the steam emitted, and is mounted on a platform moving over and along the De Brouwer conveyor on broad-gauge rails. Water is pumped through the jacket, thus protecting the steel wall, and subsequently sprinkled on the coke; the steam being led off immediately, and not causing any appreciable nuisance to the men. The width of the De Brouwer conveyor is 3·9 feet across the top and 2·5 feet on the bottom.

The movable shoot is at present worked independently of the quenching tower, on a gantry along the regenerator. But it is proposed to rigidly combine the two units—thus saving time in bringing them into position to each other and to the chamber door. A general electrical equipment will be provided for all moving appliances; manual labour or steam being employed at present for the purpose. On completion of the electrical installation, only four men will be required for the charging and discharging of the chambers; two for each operation on either side of the building.

The carbonizing period is twenty-four hours. By having one half of the chambers charged in the morning and the other half in the evening, no night work is required; and so far only one man is employed on the night shift, to look after the fires. The producers, one to each setting, are situated on the charging side, and are about 20·5 feet high. They are charged every 8 hours from a travelling coke-hopper. With a normal fuel consumption of about 14 per cent., the carbonizing results are satisfactory. As has been pointed out, no working results can be available after so short a time of operation; but the fact that the guarantee undertaken by the Contractors for a gas capacity of about 175,000 cubic feet per setting in twenty-four hours has been exceeded by over 25,000 cubic feet in a short trial run, is a very gratifying achievement.

* See "Journal," Vol. XCIX., p. 563.

Determining the Calorific Power of Combustible Gases.—A French patent has been taken out for apparatus for the above-named purpose. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the method proposed consists in burning the gas in presence of an alkaline solution, and measuring the contraction of volume and the oxygen consumed. From these data the proportions of hydrogen, carbon monoxide, methane, &c., in the gas can be calculated, and hence the calorific power. The apparatus proposed is a simple one, and allows the determination to be rapidly carried out on the spot with an error of 1 per cent. or less. It consists of a modified U-tube, one limb of which is plain and open, and is used for pressure adjustments and the introduction of absorbents and oxygen. The other limb is closed at the top by a three-way tap, above which is a cup, and at the bottom by a tap of the ordinary kind. Three superposed bulbs are blown along it, the two upper ones being close together. The uppermost one has a capacity of 17 c.c. to 20 c.c. It is furnished with a platinum spiral or electrodes. The two lower ones are from 30 c.c. to 35 c.c. capacity. The intermediate tubing is graduated to 0·1 c.c. or 0·2 c.c. The estimation of the gaseous constituents is to be carried out in the usual way.

M. DEVILLE ON REMOVING NAPHTHALENE.

In the review of the proceedings at the recent congress of the Société Technique du Gaz which appeared in the "Journal" for the 30th ult., reference was made to a paper by M. Du Pasquier on the removal of naphthalene from gas by means of anthracene oil; and it was mentioned that the principal speaker on the subject was M. Sainte-Claire Deville. We published last week (p. 43) a full abstract translation of the paper; and we are now able, through the courtesy of M. Deville, to give an indication of the scope of his remarks.

M. Deville commenced by expressing his pleasure at being able to state that the conclusions arrived at by the author of the paper were quite in accord with those resulting from many unpublished investigations into the same subject which had been carried out at the experimental works at La Villette during the past forty years. These investigations had a long time ago led him to the conviction that condensation, if rationally conducted, would produce an inoffensive gas, from the point of view of naphthalene deposits in the distributing plant. It should be noted, at the outset, that the proportion of benzol in the gas—and by the word "benzol" must be understood a group of hydrocarbons of the aromatic series containing from 70 to 80 per cent. of pure benzene—varied, according to the character of the coal, the method of carbonization, the season, &c., from 35 to 45 grammes per cubic metre (from 1530 to 1966 grains per 100 cubic feet). On the other hand, the proportion of benzol in the tar fluctuates between 0·5 and 1·5 per cent. As, moreover, the average quantity of tar corresponding to one cubic metre (35·3 cubic feet) of gas does not exceed 200 grammes, it is seen that tar is capable, according to circumstances, of retaining from 1 to 3 grammes of benzol per cubic metre of gas. Consequently, if by a system of condensation which could be easily devised, one could succeed in leaving in the gas the whole of the benzol produced in the process of carbonization, the quantity would not be increased by more than from 4 to 6 per cent. It follows from this that the effect of the method of condensation on the quantity of benzol in the gas, and also upon the illuminating power, while being very real, very easy to follow in its various phases, and very well understood in its details, is of but slight importance from the quantitative and practical point of view. Nevertheless, considerable attention was given to this subject in Paris, and with some reason, at the time when the enrichment of gas by benzol was an operation which the municipal authorities regarded as unlawful. At the present day, however, it matters little if the tar contains one or two grammes of benzol more per cubic metre of gas, inasmuch as the benzol extracted from the tar should serve for enrichment; and therefore the process of condensation should be directed solely to the absorption, as completely as possible, of the naphthalene by the tar.

M. Deville went on to remark that when the gas leaves the hydraulic main at a temperature of 60° to 65° C. (140° to 149° Fahr.), it might be said that 19-20ths of the tar has already been condensed, in the physical sense of the word. Nearly one-half (say, about 95 grammes per cubic metre of gas) remains in a liquid state in the hydraulic main, and a like quantity is carried forward, in a vesicular condition, in suspension in the gas. The rest of the 200 grammes of tar (say, about 10 grammes) forms at this moment an integral part of the gas in the state of naphthalene vapour, with a little vapour of heavy oil, phenol, and benzol. These should not be regarded as a group of vapours susceptible of being or not being eventually condensed, but as a collection of gases which are destined to be more or less rapidly absorbed, as the result of a phenomenon of simple dissolution, by the vesicular tarry liquid in suspension—a liquid in which their solubility increases proportionately with decrease in temperature. Besides, contact is so much the more intimate between these gases and their dissolvent as the equilibrium of tension is established so to speak instantaneously as soon as the temperature is modified, whatever the rapidity with which the change is produced.

Under these conditions, said M. Deville, if, after the gas had left the hydraulic main, it was conveyed into large pipes where it could remain at rest without cooling to a notable degree, a considerable quantity of the vesicular tar would deposit by virtue of its weight, and would flow away by the syphons while it was still warm, and before it had been able to dissolve the portion of the naphthalene vapour which had accrued to it. Farther on, when cooling was taking place more actively, there would no longer be sufficient tar, and the solution of naphthalene which would be produced would be a *quasi*-saturated one. The gas, in separating from it, would, as M. Du Pasquier had shown, be nearly saturated with naphthalene at the temperature of separation; and, consequently, if it subsequently passed through pipes which were colder, condensation of naphthalene would take place, If, on the other hand, as soon as the gas left the hydraulic main it was made to pass through a powerful condenser—something analogous to a very large Junkers calorimeter—the 95 grammes of vesicular tar would remain, at a low temperature, at the disposal of the 10 grammes of vapours of naphthalene and phenol. The dissolution thus effected would be considerably more extended than the preceding one, and the tension of naphthalene vapour in the gas which would separate would be lower than the maximum tension of pure naphthalene at the temperature of separation. The gas would leave the condenser not saturated, and would be able to undergo subsequently a certain amount of cooling without any danger. These considerations led M. Deville to the conclusion that the axiom generally accepted, that condensation should be conducted slowly and progressively, was simple irony; for he was not aware that any direct proof had ever been given of its utility from the special point of view with which he was then concerned.

Before concluding, M. Deville said he might just remark that they had been told that the carbonizing chambers at Munich produced gas which was quite free from naphthalene; but nothing was said about the quantity contained in the tar. Personally, he should be greatly surprised if it was less than that of the average tars produced in works in which ordinary retorts were used. However this might be, he estimated that the abolition of the hydraulic main in the case of these furnaces would be sufficient to account for the absence of naphthalene in the gas, even if it were proved that carbonization in the chambers produced it to the same extent as in ordinary retorts. In fact, at Munich, the gas, on leaving the setting, passed directly into a kind of foul main, in which was deposited a small quantity of thick tar, representing about 3 per cent. of the total production. Practically the whole of the tar was consequently carried forward with the gas, and took the form of a vesicular cloud. The vesicles were lighter, and doubtless deposited more slowly than in the case of works using retorts, for the reason that each retort was not burdened with a core of fixed carbon. It was extremely probable that when the gas reached the places where cooling was active, it still contained a quantity of vesicular tar very much larger than that which followed it up to the condenser in ordinary gas-works. It was not surprising, therefore, that it was, in a manner, better washed of its naphthalene. M. Deville said he supposed that in settings of vertical retorts something analogous went on. There was certainly a hydraulic main in use, but it seemed to take out very little tar, thus leaving a greater quantity at the disposal of the naphthalene vapour at the moment of cooling. To sum up, to cool the gas as soon and as completely as possible seemed to him to be the secret of good condensation, the moment one ceased to be concerned about benzol.

International Congress of Applied Chemistry.

The Seventh International Congress of Applied Chemistry will be held in London from May 27 to June 2, 1909; and an Organizing Committee has been formed for the purpose of making the necessary arrangements. The previous congresses took place in Brussels, Paris (twice), Vienna, Berlin, and Rome; and it is hoped that the one to be held in the Metropolis may be a worthy successor to them. The congress is under the patronage of His Majesty the King and H.R.H. the Prince of Wales; the Hon. President is Sir Henry Roscoe, and the acting President is Sir William Ramsay; the Hon. Joint Treasurers are Messrs. T. Tyrer and C. Wightman; and the Hon. Secretary is Mr. W. Macnab. A meeting of the Joint Organizing Committee was held at the Royal Society's Rooms, Burlington House, on Monday last week, under the presidency of Sir W. Ramsay, when it was resolved to commence at once the formation of the British Committees for the several sections; choosing as Secretaries gentlemen who, as far as possible, other things being equal, are linguists. The centre of proceedings will be the buildings at South Kensington of the London University, the Imperial Institute, and the Imperial College of Science, which will furnish ample accommodation for the sectional meetings. The opening ceremony will take place in the Albert Hall, and it is hoped will be performed by the Prince of Wales. The provisional programme comprises the inaugural gathering, a *conversazione* at the Natural History Museum, and a banquet at the Crystal Palace.

Sheffield Corporation Water-Works.—Some time ago, Mr. W. Terrey, the General Manager of the Sheffield Corporation Water Department, was requested by the Principal of the University College to deliver two lectures on the subject of the water supply of the city. He complied with the request; and the lectures, which were much appreciated by large audiences, were noticed in the "Journal" at the time. As Mr. Terrey's work involved considerable research, the Water Committee expressed a desire that the particulars collected, which constituted a connected history of the water undertaking, should not be lost; and the author was accordingly requested to put the lectures into permanent form. This he has done; and the result is an interesting book of nearly a hundred pages, freely illustrated with reproductions of photographs. In a short introduction by Alderman Gainsford, who for twenty years was Chairman of the Water Committee of the Corporation, he points out that throughout the book the author has omitted all reference to his own share in the work described; and he expresses the opinion that Sheffield was fortunate in securing Mr. Terrey at a critical time to manage their newly-acquired undertaking—first in conjunction with Mr. E. M. Eaton, and of late years as General Manager. He adds: "Mr. Terrey's careful and judicious management and advice, his foresight in framing schemes for the development of the undertaking, and in carrying the same through Parliament and into execution, constitute a record of valuable work for which Sheffield is under much obligation to him."

REPORTS OF THE TECHNICAL COMMITTEES OF THE GERMAN GAS ASSOCIATION.

PHOTOMETRIC COMMITTEE.

The Photometric Committees held two sittings in the past year in Berlin. At the first sitting the researches on the long-distance gas-main between Lübeck and Travemünde, which had been carried out by Herr Hase, the Manager of the Lübeck Gas-Works, were discussed in detail. It was decided, with a view to clearing up some discrepancies obviously due to fortuitous circumstances, to make further investigations in the winter of 1908. Dr. Krüss reported on the work and conclusions of the International Photometric Committee. In this connection, the method for the determination of mean spherical intensity by means of the Ulbricht sphere was discussed. Dr. Krüss described one of these spheres of 2½ metres (8·2 feet) diameter which he had made. He also described an integrating photometer he had made, in which the images of the sources of light coming from different directions are projected on a matt-surfaced glass disc, of which the brightness is measured photometrically. For obtaining the polar curve, the different directions are measured successively; for determining the mean spherical or hemispherical illuminating power, all the images are projected at the same time and the sum of their brightness is determined.

At the second sitting, the researches on the Lübeck and Travemünde long-distance gas-main were still further discussed. The Photometric Committee decided to formulate instructions for the photometry of high-power sources of light and inverted gas-lamps. It was agreed to make further inquiries as to the advantages of the Ulbricht sphere. The question was raised as to the establishment of regulations for the delivery of mantles; but it was decided not to do anything in this direction. Some discussion also took place on the photometric testing of different qualities of gas from various systems of retorts, and of mixtures of coal gas and uncarburetted water gas, and water gas carburetted either with benzol or petroleum oil, and on the influence of such admixtures on lighting by mantles, more especially in regard to the regulation of the air supply to the burners.

The Photometric Committee also considered the matter referred to them at the last year's meeting of the Association as to whether the rules for the photometry of electric arc lamps made by the German Association of Electricians, could be adopted in principle for street gas-lamps; and, if so, with what modifications. These rules make the mean lower hemispherical illuminating power the practical measure of the duty of an arc lamp; but they provide a factor by which the lower hemispherical illuminating power is to be multiplied in order to show the mean spherical illuminating power. These conditions assume that the light emitted in the lower hemisphere is alone of importance in outside lighting; but the Photometric Committee conclude that the acceptance of this assumption in all cases would lead to some very serious misconceptions. They are of opinion that only by reference to the polar curve of light emitted can a sure ground be obtained for laying out a lighting installation—that is to say, for determining the proper height of the lights and their distance apart and distribution. Two ways may be adopted for determining the polar curve. The first of these is to ascertain, by suitable photometric apparatus, the intensity of the light at every 10 or 15 degrees about the horizontal axis of the source of light. Photometers for this purpose have been devised by L. Weber, Brodhun, and Vriess.

The second method is, however, more convenient. It involves the use of one or more mirrors. Apparatus of this kind, with one mirror, has been devised by Hefner-Alteneck, Perry and Ayrton, Drehschmidt, and Krüss; with two mirrors, by Laporte and Matthews; and with three mirrors, by Krüss and Stuschkowitsch. From the appropriate curve determined by such apparatus the mean spherical and the mean hemispherical illuminating powers can be calculated very simply. Though the Committee could not accept the principle that the mean lower hemispherical illuminating power should alone serve as a practical measure of the duty of a source of light, they realized that some convention should be adopted to overcome the unfortunate position by which certain observers assess the duty on the basis of the horizontal, others on the maximum, and yet others on the mean spherical illuminating power. The decision of the International Photometric Committee, arrived at last year, at the session in Zurich has, however, settled this difficulty. The International Committee adopted the symbol I to represent illuminating power, and attached to it an index indicating the conditions to which it applied. The following are the symbols adopted:—

I_h = Horizontal illuminating power.
$I_{\alpha s}$ = Illuminating power at the angle α to the horizontal plane above that plane.
$I_{\alpha i}$ = Illuminating power at the angle α to the horizontal plane below that plane.
$I_{m\alpha s}$ = Maximum illuminating power at the angle α above the horizontal plane.
$I_{m\alpha i}$ = Maximum illuminating power at the angle α below the horizontal plane.
I_o = Mean spherical illuminating power.
$I_{\supset}$ = Mean hemispherical illuminating power above the horizontal plane.
$I_{\subset}$ = Mean hemispherical illuminating power below the horizontal plane.

The Photometric Committee recommends the German Association to adopt these symbols.

Researches were carried out by Herr Hase, of Lübeck, at the instance of the Photometric Committee, with a view to ascertain whether the gas pumped under high pressure to Travemünde underwent any appreciable change in the course of its transit to that distance. Further, the question of the application of existing formulæ to the transmission of gas under pressure to a distance was investigated. The experiments were made in a simple manner; but the results obtained may claim to be fairly conclusive. The illuminating power of the gas was determined in an argand burner consuming 150 litres (5·3 cubic feet) per hour; and the calorific power was determined with a Junkers calorimeter. The high-pressure gas-main is 80 mm. (3·16 inches) in diameter and 20 kilometres (about 12½ miles) in length. At each end of the main determinations were made of the pressure, illuminating power, calorific value, and specific gravity of the gas. The temperature of the gas was read before and after the blower in Lübeck, and at Travemünde, as well as the maximum, minimum, and average temperature of the earth and atmosphere. The corresponding measurements were made at Lübeck and Travemünde, at such an interval of time as would coincide with the passage of the gas from one end of the main to the other. The experiments were carried out at six different initial pressures at Lübeck—namely, 137 mm. (5·4 inches), 1555 mm. (61·2 inches), 1705 mm. (67·1 inches), 2356 mm. (92·7 inches), 3158 mm. (124·4 inches), and 3918 mm. (154·4 inches). At the pressure of 1555 mm., as many as twenty-two different experiments were made on twenty-two different days.

The results of the experiments may be summarized as follows: The illuminating power of the gas is generally reduced only to a very trifling extent by the compression and transmission. The diminution increases with the pressure, and attains a maximum when the gas is cooled to very low temperatures. Expressed in percentages, the decrease in illuminating power at the lower pressures is *nil* to 4 per cent., and at higher pressures 6 to 8 per cent.; while in winter it may on occasion be as much as 25 per cent. The calorific power of the gas is likewise reduced to an inconsiderable extent; at the lower pressures by 1 to 2 per cent., at the higher pressures by 0·3 to 1 per cent., and in the winter by 2 to 4 per cent. The decrease in this case also is greater in winter than in summer; but, strangely enough, it is less as the pressure rises. This point was further investigated during the past winter; and it then appeared that poor gas suffered greater decrease at high pressures than at low pressures, though gas of specially high calorific power showed the converse relation, but in small degree. The decrease in specific gravity is also inconsiderable; amounting to a maximum of 2·7 per cent. in summer, and 4·5 per cent. in winter.

Comparing the quantities of gas transmitted with those calculated by Pole's formula, it was found that at low pressures they were smaller than the calculated quantities, and at higher pressures greater. The difference between the actual and the calculated quantities fluctuated between − 11·61 per cent. and + 19·26 per cent. It may be taken as established that, speaking generally, the transmission of gas to great distances under high pressure is not attended with any serious deteriorating effect on the gas. The formulæ, however, hitherto used for calculating the size of main, the quantity of gas transmitted, and the fall of pressure, do not give correct results in such cases. The Committee consider that the experiments should be pursued and extended in many directions. For instance, the apparently contradictory behaviour of the gas in respect of illuminating power and calorific value needs clearing up. Some influences not ascertained probably influenced the results. It is proposed to apply registering jet photometers at each end of the main, and to utilize the results given by them in conjunction with careful determinations of illuminating power and calorific value for a further investigation of this point.

The Committee asked for, and were voted, a further grant of 900 marks (about £45) for the continuation of their researches in the ensuing year. The report is signed by Dr. Leybold, of Hamburg, as Chairman.

HEATING COMMITTEE.

The Association, acting on the suggestion of Professor Reitschel, participated, through the medium of this Committee, in the Exhibition of Hygiene which was held in Berlin in September last in connection with the Fourteenth International Congress of Hygiene and Demography. The Committee regarded it as their primary duty to direct attention to the hygienic side of the gas industry by means of diagrams and statistics, which would serve to display the results of the work of the Committee on the construction of gas-fires and on the disposal of the products of combustion. This exhibition was very actively supported by several firms; and Professor Junkers deserved special thanks for the instructive models which he exhibited. These models have now been transferred to the Instructional and Experimental Works of the Association at Carlsruhe. The great need for advice on such matters was clearly shown by the appreciation with which

a medal bestowed by the Association for this exhibition was received, as well as by the interest taken in the pamphlet which the Committee issued, entitled "Guide to the Proper Construction, Fitting, and Manipulation of Gas-Fires." The Committee do not consider, however, that the matter is yet settled, and desire in particular to study further the question of the discharge of the products of combustion from gas-fires.

It had been agreed with Professor Reitschel previously that the most important rule to be followed was one to the effect that large gas-fires which are connected to a flue must be so constructed and installed that the possibility of incomplete combustion or of extinction of the flames is quite excluded, even if the flue temporarily fails to fulfil its purpose. One of the most efficient means of securing the object aimed at by this rule is the so-called "intermitter" of Professor Meidinger, which has been favourably mentioned to the Committee by many people. But the Committee do not at present regard it as being wholly satisfactory; and further experiments are to be undertaken with a view to finding similar apparatus with automatic valves which will place the flue in free communication with the room only when there is a positive pressure in the chimney.

The Committee have also considered it important that the public should be enlightened as to the proper handling of heating appliances, and have included in the guide referred to directions as to the correct method of lighting fires and turning the taps on and off. Explanations have been added as to the appearance of flames in which the combustion is complete, and of flames in which, through insufficient air supply, combustion is incomplete. A coloured print was produced showing the correct and faulty flames, and has been extensively distributed through the medium of gas-works and of hygienic and other institutions. The guide has also been placed by the Prussian Minister of Public Works at the disposal of all the officers of works.

The Committee are of opinion that, in addition to the proper instruction of fitters, such as is undertaken by the Instructional Committee of the Association, as well as by numerous training schools, it would be very useful if the work of fitters were controlled by prescriptions as to the installing of gas appliances in private houses. Without control, the fitters are liable to instal apparatus in a manner which does not comform with the requirements of safety. The District Association of Saxony-Thuringia, in 1902, introduced a scheme for the issue of directions and prescriptions for the manufacture, use, and maintenance of gas apparatus in private houses; and this scheme has formed the basis of regulations made by many local authorities. The rules are of great assistance to gas-works in preventing interference by outside fitters with the services leading to consumers' meters. They also serve the useful purpose of providing official supervision of the work of the fitters, thereby engendering a feeling of safety to the public, and preventing interference with, or limitation of, the use of gas by too zealous authorities. But the gas industry must take the initiative in showing by what means danger can be avoided and the safety of the public secured.

Before the Committee revise the "Guide to the Proper Construction, Fitting, and Manipulation of Gas-Fires," they would be glad to have the opinion of the general meeting on three points of importance in regard to its further work. These points are:

1—Whether the Association consider it advisable that local authorities should have authority over fitters and control of the types and fitting of gas-fires.

2—Whether the Association should furnish the technical part of such prescriptions while they reserve to themselves the right to revise them at any time according to the advances in the industry.

3—Whether the enforcement of the prescriptions and the testing of gas-fires should not be carried out by persons trained in the gas industry who would be equipped with powers by the local authority, and not by the ordinary officers of the authority.

If the Association approve these suggestions, the Committee would undertake to formulate such prescriptions. As Herr Söhren had assisted in compiling the earlier guide, the Committee have co-opted him to serve on the present Committee, who now consist of nine members.

The Committee asked for, and received, a credit of 2000 marks (£100) for the continuation of their researches on the disposal of the products of combustion from gas-fires. The report is signed by the Chairman, Dr. E. Schilling, of Munich.

The presentation of the report at the meeting was followed by a lively debate on the question of the introduction of rules for the installation of gas-heating appliances; and it was ultimately decided to commission the Committee to continue their work on this question, and to bring forward definite proposals at next year's meeting.

GAS-METER COMMITTEE.

The joint work of this Committee and the Government Stamping Department during the past year has come now to a fairly definite conclusion. The investigations on the one hand have indicated the causes of failure of the diaphragms of treated fabric in the past, and on the other have furnished data for the dressing of the fabric so that there shall be little doubt that it will withstand the action of gas and the products deposited from it. The chief points in the earlier work are indicated in the following summary of the results arrived at: (1) Pure linseed oil may be unhesitatingly employed for preparing fabric diaphragms, provided the fabric is properly selected, and the oil with which it is saturated is "resinified" to a proper degree—that is to say, is converted by oxidation until it contains the maximum proportion of 79 to 80 per cent. of linoxyn. (2) The methods devised for testing the treated fabric will indicate with certainty whether the required degree of resinification has been realized, or to what extent it has reached. (3) Fabric diaphragms which have been in continuous use in dry meters for 20 to 25 years have been found to be still sound and supple; they could be unquestionably regarded as equal to leather diaphragms in respect of durability. It should be borne in mind that at the time these old diaphragms were made, there were no methods for determining the amount of linoxyn contained in them.

It was realized some time ago that the trustworthiness of these conclusions of the Committee must be tested through a comprehensive series of practical trials of the prepared fabrics. To this end, the collaboration of Messrs. Elster and Co., of Mayence (a firm of meter makers), was secured, and fabrics which had been approved by the Stamping Department, or investigated in the laboratories of members of the Committee, or in the Experimental and Instructional Works of the Association at Carlsruhe, were incorporated by the firm in a number of trial meters. The co-operation of 14 gas-works was obtained in practical trials of 94 five-light meters so made. The works were chosen with a view to subjecting the fabrics to, as far as possible, every variety of gas, and included works making coal gas more or less enriched by benzol, or mixed with uncarburetted or carburetted water-gas, and coke-oven gas. It seemed useless to get more trial meters, or meters of other sizes—indeed, for comparative purposes, uniformity of size was desirable. The trials have only been started a short time, and the report on them must be given at a subsequent meeting.

The Committee have reported several times on the stamping of meters, and the bearing thereon of the provisions of the new Weights and Measures Bill. Last year it became evident that it would be necessary to petition the new Reichstag for a change of the proposed enactment requiring the periodical re-stamping of gas-meters in use; and this was done. The Council of the Association addressed a third petition to the Reichstag on the matter on Jan. 8 last; and when the Reichstag on May 7 read the Bill for the third time, it adopted the terms asked for by the Association. Section 11 of the Weights and Measures Act, which stipulates for the re-standardizing of commercial weights and measures, has an *addendum* which excepts gas-meters from the provisions of the section. The gas industry is thereby relieved from the great burden which the Bill, as originally drafted, would have thrown upon it. The Imperial Standards Commission have also shown great interest during last year in the work of the Committee, and have sent representatives to their meetings. The Committee desire to express their thanks to these authorities, and also to the managers of gas-works who have assisted in the tests of fabrics in trial meters.

The Committee asked for, and were granted, a sum of 500 marks (£25) for the continuance of their work in the ensuing year. The report was presented by Herr C. Kohn, of Frankfort-on-Maine, who is the Chairman of the Committee.

Last Tuesday, at the Middlesex Guildhall, a testimonial was presented to Sir Ralph Littler, C.B., K.C., in recognition of his services to the County of Middlesex during the 21 years he has been Chairman of the County Council and Quarter Sessions. The presentation was made in private; but it is stated that the amount handed over to Sir Ralph was £1300.

We have received from Mr. James Hewett, the Hon. Secretary, a copy of the "Transactions," 1907-8, of the Midland Junior Gas Engineering Association, reprinted in book form from the pages of the "JOURNAL." This is a record of the proceedings during the third session of the Association, the papers contributed to which exhibited no falling off in interest when compared with those contained in the two preceding volumes. Among the accounts of visits is, of course, included that which the Association, jointly with the other English Junior Gas Associations, paid last November to the Manchester Gas Exhibition. Copies of the volume, and of those recording the business of the preceding sessions, may be obtained from Mr. Hewett, Fern House, Washwood Heath Road, Birmingham; the price being 2s. 6d. in paper covers, and 3s. 6d. in cloth.

According to a description which appeared in a recent number of the "Engineer," the Federal Fuel-Testing Laboratory at Zurich, which was started two years ago, and noticed in the "JOURNAL," has already done much to ensure that Switzerland receives the proper equivalent for the £3,000,000 annually expended on imported fuel. In the first year of its existence, besides research work, above 3300 samples of coal and briquettes were examined. Most came from Germany, and the rest from Belgium, France, and England. This extensive examination of imported fuels has tended to enlighten the consumers as to the qualities and economic value of fuels bought from the various countries and collieries, and has contributed towards their classification according to heating power. A hope is expressed that this may soon be universally adopted as the basis of coal contracts, instead of the vaguely defined evaporation power or the percentage of combustible matter.

ALKALI WORKS CHIEF INSPECTOR'S REPORT.

[Second Article.]

In the "Journal" last week (p. 24), we noticed the first portion of the annual report of Mr. R. Forbes Carpenter, the Chief Inspector under the Alkali Works Act, 1906. We now take up the sections in which Mr. Carpenter deals with the constitution of ammoniacal liquors and other matters.

Constitution of Ammoniacal Liquors.

It was mentioned last week that some samples of ammoniacal liquors from various sources had been examined in the Chief Inspector's laboratory during the past year, but that no time had been available for prolonged or continuous research. Tabulated results, however, are given of liquors from the setting of eight retorts, inclined at an angle of 45°, at the Guildford Gas-Works, in comparison with those obtained from the horizontal retorts of exactly the same length and sectional area in gas-works carbonizing the same coal, and of samples concurrently procured of liquors from the vertical retorts at the Poole and Bourne Valley works of the Bournemouth Gas and Water Company. These tables are reproduced below.

Mr. Carpenter explains that in the case of the vertical retorts the liquor in many respects resembled that from a Scotch iron-works in the amount of phenoloid bodies present. He points out that the cyanogen content of the liquor is not low, although it would appear from a statement by Mr. Woodall (referred to later) that the purified gas contained only traces of volatile cyanogen when tested at an earlier stage of the experiments. Mr. Woodall subsequently, at Mr. Carpenter's request, made a further estimation of the cyanogen content of the gas at Poole under the conditions prevailing when sample (*b*) in the accompanying tables was collected. The results showed that an amount quite usual in ordinary high-temperature carbonization was in the scrubbed gas. This occasioned some surprise to Messrs. Woodall and Duckham, as the periodical examination made for naphthalene in the tars showed regularly a very marked reduction in the secondary product, one peculiarly indicative of high-temperature conditions in the retort. In the case of the Guildford gas-plant, the cyanogen compounds in the liquors are extremely low. Systematic tests as regards volatile cyanogen in the gas do not appear to have been as yet applied.

Cyanogen Compounds in Gas Liquors.

In regard to the subject of means taken to reduce the amount of volatile cyanogen compounds in gas liquors before distillation,

Tests of Liquors from the Guildford, Poole, and Bournemouth Gas-Works.

Liquor.	Degrees Twaddel.	Ferrocyanide, calculated as HCy, grammes per 100 c.c.	Chloride, calculated as HCl, per 100 c.c.	Ammonia. Total. Per 100 c.c.	Ammonia. Fixed. Per 100 c.c.	Ammonia. Free. Per 100 c.c.	Ammonia. Free. A. H.E.	Carbonic Acid. Per 100 c.c.	Carbonic Acid. B. H.E.	Sulphuretted Hydrogen. Per 100 c.c.	Sulphuretted Hydrogen. C. H.E.	Hydrocyanic Acid. Per 100 c.c.	Hydrocyanic Acid. D. H.E.	Total Acids (B + C); H.E.	Difference of Acids (B + C − A) H.E.	Difference of Acids (B + C − A) NH_3. H.E. = 100.	Saturator Gases contain (by Theory). CO_2	H_2S.	HCy.
Guildford Company.																			
Ex condensers—																			
8 inclines (45°)	8½	Traces	·525	2·554	·523	2·031	119·5	3·696	168·0	·195	11·5	·017	0·6	180·1	+60·6	+50·7	92·9	6·4	0·7
48 horizontals	8	·017	·313	3·468	·221	3·247	191·0	4·037	183·5	·384	22·6	·043	1·6	207·7	+16·7	+ 8·7	87·7	10·8	1·5
Liquor as distilled*	4⅜	Traces	·730	1·649	·501	1·148	67·5	2·156	98·0	·610	3·6	·002	·07	101·7	+34 2	+50·7	96·4	3·5	0·1
Bournemouth Company.																			
Poole works—																			
(*a*) Vertical	4	Traces	·611	1·760	·432	1·328	78·1	1·386	63·0	·406	23·9	·050	1·8	88·7	+10·6	+13·6	69·6	26·4	4 0
Horizontals	5	Traces	·546	2·116	·365	1·751	103·0	2·068	94·0	·260	15·3	·046	1·7	111·0	+ 8·0	+ 7·8	83·4	13·6	3·0
(*b*) Vertical	..	·008	·302	0·843	·202	0·641	37·7	0·583	26·5	·342	20·1	·063	2·3	48·9	+11·2	+29·7	51·6	39·2	9·2
Bourne Valley works—																			
(*c*) Verticals	..	Traces	·527	1·266	·238	1·028	60·5	1·710	77·7	·075	4·4	·004	0·2	82·3	+21·8	+36·0	94·3	5·3	0·4
(*d*) Do. virgin liquor	..	absent	·542	1·943	·366	1·576	92·7	2·161	98·2	·078	4·6	·006	0·2	103·0	+10·3	+11·1	95·2	4·4	0·4

* Gases from the two sets of condensers mix and pass through washers, &c., together. The condenser liquors run to the same well.

Distribution of Cyanogen Compounds.

Liquor.	Grammes per 100 c.c. Total Ammonia.	Cyanogen in Terms of HCy. Cyanide.	Thiocyanate.	Ferrocyanide.	Total.	Distribution of Cyanogen. Per Cent. of Total Present. Cyanide.	Thiocyanate.	Ferrocyanide.	Per Cent. Total Cyanogen to Ammonia.
Guildford Company.									
Ex condensers—									
8 inclines (45°)	2·554	0·017	0·025	Traces	0·042	40·5	59 5	..	1·6
48 horizontals	3·468	0·043	0·025	0·017	0·085	50·6	29·4	20·0	2·4
Gas liquor as distilled	1·649	0·002	0·037	Traces	0·039	5·1	94·9	..	2·3
Bournemouth Company.									
Poole works—									
(*a*) Vertical	1·760	0·050	0·137	Traces	0·187	26·7	73·3	..	10·6
Horizontals	2·116	0·046	0·094	Traces	0·140	32·9	67·1	..	6·6
(*b*) Vertical	0·843	0·063	0·044	0·008	0·115	54·8	38·3	6·9	13 6
Bourne Valley works—									
(*c*) Verticals	1·265	0·084	0·160	Traces	0·164	2·5	97·5	..	12·9
(*d*) Do. virgin liquor	1·942	0·006	0·067	*Nil*	0·073	8·2	91·8	..	3·8

Distribution of Fixed Ammonia.

Liquor.	Ammonia, in Grammes per 100 cc. (Calculated) as Chloride.	Thiocyanate.	Ferro-cyanide.	Thiosulphate Equivalent of N/10 Iodine.	Thiosulphate and other Forms (by Difference).	Total Fixed Ammonia Found.
Guildford Company.						
Ex condensers (virgin liquors):—						
8 inclines (45°)	0·252	0·016	Traces	(0·227)	0·255	0·523
48 horizontals	0·146	0·016	0·004	(0 098)	0·055	0·221
Gas liquor as distilled (*ex* condensers *plus* washers)	0·341	0·023	Traces	(0·102)	0 137	0·501
Bournemouth Company.						
Poole works—						
(*a*) Vertical	0·285	0·086	Traces	[0·010]	0·061	0·432
Horizontals	0·255	0·059	Traces	[0·017]	0·051	0·365
(*b*) Vertical	0·141	0·028	0·003	[0·017]	0 030	0 202
Bourne Valley works—						
(*c*) Verticals	0·059	0·100	Traces	[0·040]	0·079	0·238
(*d*) Do. virgin liquor	0·253	0·042	*Nil*	[0·034]	0·071	0 366

experimental work proceeded in various quarters during the past year in coke-oven works and also in gas-works. In the laboratory connected with one of the former, careful comparative tests were made as to the difference of conditions obtaining in works of these two classes respectively, from the point of carbonizing and onwards throughout the condensing and scrubbing processes. Some of the results and conclusions are quoted here as being instructive as regards the lines on which success is not to be hoped for, and indicating that any reduction of volatile cyanogen must be effected in the liquors before distillation, and not hoped for by applying any absorbent to the gases resulting from such distillation.

The research experiments at . . . showed clearly that the polysulphide method cannot cope with the HCN absorption in our oven gases, the following being the obstacles which cannot be surmounted.

1.—The low percentage of ammonia in the cooled gas. For obvious reasons, the moistures we deal with run to 12 per cent., and often higher when bunkerage is limited; gas-works coal is practically dry. Without taking into consideration the higher percentage of hydrate water of our coking smudges, compared with that of rough coal, it is clear that the cooling of coke-oven gas brings down heavy quantities of water (condensings) containing ammonia and ammonia salts. Thus, our cooled gas, freed from most of its tarry constituents, has lost from 80 to 85 per cent. of its original ammonia. At ——— only 15 to 17 per cent. of the total ammonia remains to be washed out in the scrubbers; the rest coming down in the condensings. On the other hand, the retort gas contains the greater portion of its ammonia after cooling and passing through the tar cleaners. Since the creation of a strong polysulphide solution is essential to the HCN absorption, and the strength of the same is directly dependent upon the ammonia tension—or, more correctly expressed, upon the ammonium sulphide tension—in the gases, the capability of our oven gases remains very limited; indeed, tests at ——— gave very poor polysulphide liquors with only a slight precipitation of sulphur on addition of acid.

2.—The lower percentage of HCN in the oven gases which complicate the process of absorption. Bye-product coke-oven gas contains only about two-thirds of the HCN amount in gas from retorts.

3.—The presence of carbon dioxide (CO_2) in oven gas. It is clear from the nature of the coking process that the gas obtained runs higher in carbonic acid than the retort gas. In ——— up to 3 per cent. volume of CO_2 is found in the cooled gas. These large quantities of CO_2 oppose the creation of polysulphide, and destroy the latter to a considerable extent. Thus—

$$(NH_4)_2S_2 + CO_2 + H_2O = (NH_4)_2CO_3 + SH_2 + S.$$

Our coke-oven gas, on being passed through polysulphide solutions, such as used at Leamington or Bradford, enriches itself with ammonia and gradually precipitates sulphur out of solution, confirming the accuracy of conclusions drawn from the above-mentioned facts, and showing how much weaker the polysulphide obtainable from coke-oven gas would be.

Finally, our tests brought to light the great difficulty in working up a polysulphide solution in the unavoidable presence of light tarry substances and phenols. These latter penetrate through the Pelouze apparatus, and cling to the sulphur on reaching the cyanide scrubber, hindering its action.

This final difficulty is, of course, one met with in operations in gas-works as well as in coke-oven works—wherever, indeed, coal is carbonized. Hence the need, in applying any polysulphide process, based on solution of sulphur in warm ammoniacal liquor, with observance of every precaution, to hinder access of tarry particles, which coat the sulphur presented to the liquor for solution, first retarding and finally stopping any interaction between them.

No success was met with during the year in other works, either technically or commercially, with renewed attempts to convert the volatile cyanogen into an insoluble ferrocyanide, either in the liquors in the store-tanks before distillation, or from the gases and vapour from the still before reaching the saturator. In the latter experiments there was not a high percentage conversion, and the additional drawback of blue salt appearing in the saturator showed that iron salt had formed from the cyanide washer. This line of experiment, therefore, was abandoned. For the present, therefore, the only method of general application to be classed as the "best practicable means for preventing the discharge, whether directly or indirectly, of noxious or offensive gases into the atmosphere, and for rendering such gases where discharged harmless and inoffensive" (*vide* section 7 of the Act of 1906), would appear to be, in the case of such of the coke-oven recovery works where the foul gases are returned to the scrubbing and condensing plant, to keep under suction the saturator itself and all plant that succeeds it in series.

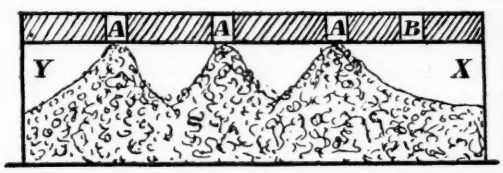
Nuisance from Coke-Oven Plants.

Before leaving the subject of coke-oven plants, reference may be made to one of the great nuisances accompanying the charging of the ovens, and on which evidence was given before the Royal Commission on Noxious Vapours in 1878, leading to the scheduling of coke-oven works in the Government Bill of 1879, based on the report of the above. Already, in one case, legal proceedings had followed on the introduction of coke-ovens with recovery plant for residuals in the neighbourhood of Bolton. After protracted proceedings, a satisfactory settlement has been reached for some time past.

The chief cause of complaint of injury to cattle and to hay was stated by the tenant of neighbouring agricultural land to proceed from the brown gas evolved on charging the ovens and levelling the charges before closing the doors for coupling-up the oven again to the hydraulic main. The managers have necessarily had their attention directed closely to this particular source of nuisance to others and of loss to themselves, with the result that alterations have been made (experimentally, of course, at first) in the ovens by which these gases, the primary cause of offence, are drawn off directly to the flue, and pass to the fireplaces of steam-boilers, which are adjacent to the ovens, where they are utilized for steam raising.

Notwithstanding objections that were raised and doubts that were naturally entertained as to the probable non-efficiency of the means for closing access to this flue completely during the coking period, no evil results have followed; so that now 16 ovens —nearly one-third of the total—are so fitted. The ovens are being altered as they come for repair. Since a close watch is kept on the yields at this work, it seems certain that any loss of bye-products by improper action of the additional flue would have long since declared itself. I am indebted to Mr. Wallwork for the following description of this patented device.

In the ordinary process of charging, where the coal is run into the oven through the crown of the coking chamber, the coal, until it has been levelled, "builds up," dividing the chamber into sections, as shown in the subjoined diagram (in which A, A, A, are the charging-holes and B is the gas uptake).



It is evident, therefore, in order that a smoke-withdrawing influence may be effectual, it must be common to all parts of the oven—that is to say, suppose a fan or other draught were induced at X, it would not operate at Y, as the unlevelled coal would prove a barrier. In his invention, Mr. Brown has, therefore, connected up each section of the coking chamber to a common flue situated in the crown of the oven and extending throughout its entire length. The gases from all parts of the coking chamber pass into this common flue, which is connected up at the end of the ovens to the heating-flue. At the point where this common smoke-flue joins the heating-flue, a damper is placed which can be easily opened and shut as required.

In addition to being valuable to use for the removal of smoke, the device is proving of great service in the following directions: (1) The last portions of gas given off from a charge of coal are practically valueless except for the heat they contain. [See table on p. 114.] In the ordinary process, these gases are cooled by being conducted through the condensing plant, serving little purpose, and, on the other hand, shortening the life of the ironwork, and causing trouble through formation of pitch. By means of this bye-pass, we can divert these hot gases into the heating-flues; thereby making use of their heat, with a corresponding saving of the washed whole gas, which is thereby available for other purposes. (2) The smoke and gas which ordinarily pass into the atmosphere during the recharging process are, of course, by means of the bye-pass, carried under the boilers to raise steam.

Incidentally, it would appear that the separation of gases towards the end of the charge renders the condensing plant more efficient in its duty in regard to the balance of gas.

Feld's Washer for Removing Tar and Dust from Gases.

The next matter to which Mr. Carpenter directs attention is the washer of Herr Walther Feld, the English patent for which was published in 1905. He says that in this was presented an entirely novel method of recovering ammonia and other compounds from coal gas or coke-oven gas. The special feature of the patent was the employment of a washer of very ingenious design and construction, which could be applied first to the extraction from the gases of tar, next of cyanogen, and then of ammonia. The reactions securing the formation of commercial sulphate of ammonia were of extremely novel and even daring type, since it was not to be expected that completeness of chemical reactions, securing removal of the entire ammonia from the gas, could be attained with so neutral a substance as gypsum, in presence of carbonic acid. That the process in this respect needed some adjustment became manifest by the publication of the second patent of 1906; this containing specific directions as to maintaining a due proportionate relationship between the ammonia and carbonic acid in the crude gases to be purified.

The washer, which was illustrated in the "Journal" for Dec. 17, 1907 (p. 843), is composed of a number of superimposed sections, each consisting essentially of a stationary basin of less diameter than that of the external casing. In the centre of the latter is a vertical shaft to which revolution is imparted by gearing at the base of the washer. To this rotating shaft is keyed an arrangement of concentric funnels which dip into the liquid in the stationary basins. Rotation causes the washing liquid to rise in the funnels and to be thrown as a fine spray towards the outer casing, at which point baffle sheets direct the ascending gas inwards, where it is intimately mixed with the washing liquor in a very finely divided state. The descending liquid overflows from basin to basin. The power to drive the apparatus, even with hot tar as the extracting liquid, is stated to be but small.

During the past year, reports reached this country that, in addition to the application of Feld's washers, and even of the entire

recovery process, in certain works on the Continent, the washer itself had been applied with the most remarkable success to the removal of dust from blast-furnace gases. This is a most notable gain, since the losses of heat produced by the presence of this dust are of so serious a character. A purification of 90 per cent. with one washer was attained—70 per cent. being guaranteed. With a three-chambered washer, an efficiency of 99 per cent. purification has been attained—a result hitherto considered impossible—operating on 30 million cubic feet of gases per day. To another blast-furnace plant washers are being applied to cleanse from dust 3½ million cubic feet of gases per hour.

Mr. Carpenter says the washer appears so applicable to a variety of operations—one of the most important being the removal of tar and dust from producer gas for use in large power gas-engines—that it is to be hoped that the washer may soon receive introduction into this country. On the Continent, at the present time, the gas-works at Königsberg are being equipped with a complete gas-purification and residuals-recovery plant. At Ilsede, near Hanover, a coke-oven plant is similarly being equipped with a complete plant to commence operation at no distant date. At the large lead-smelting works at Mechernich (Rhine Province), experiments have been made with washers of small type with the view of arresting lead fumes. These have, it is stated, been so successful that an installation capable of dealing with 43 million cubic feet of furnace gases per 24 hours has been ordered. Mr. Carpenter thinks this instance may be regarded as one of the most interesting in view of the acid character of the gases accompanying the fumes.

Carbonization of Coal.

The next section of the report is devoted to the above subject. It is of so much interest that it is reproduced elsewhere almost in its entirety.

Testing for Sulphuretted Hydrogen.

In dealing with sulphide works, Mr. Carpenter makes some remarks on the lead paper test for sulphuretted hydrogen in the presence and absence of sulphur dioxide. He points out that the discoloration obtained on lead acetate paper by the action of sulphuretted hydrogen affords a valuable means of identifying this impurity in gaseous mixtures. Not only is the test an extremely delicate one for qualitative use, but the degree of discoloration obtained affords, under normal conditions, an approximate measure of the quantity present. In certain cases, however—*e.g.*, exit gases from the Claus process—it was noticed at an early date by the inspectors that lead paper often failed to denote the presence of sulphuretted hydrogen, even when analysis showed it to be present in more than traces, and the characteristic odour of the gas was clearly perceptible to smell. This anomaly was shown to be due to the presence of sulphur dioxide in excess. On removing the latter by shaking with water and hydrogen peroxide, which appears to act but slowly on sulphuretted hydrogen in highly dilute solution, the residual gases were found to discolour the test-paper in the usual way. This anomalous behaviour, however, was held to be exceptional, and to be characteristic only of gases containing sulphur dioxide in notable amount.

Experiment shows, however, that the sensitiveness of lead acetate paper to sulphuretted hydrogen is subject to wide variation, according to the manner of applying the test. Not only is the depth of tint influenced by the condition of the test-paper as regards moisture and alkalinity, but in even greater degree by the angle at which the gaseous stream strikes the paper; while the presence of even a small amount of sulphur dioxide (less than a grain per cubic foot) is found to affect the result to a notable extent. The qualitative indications of the test, therefore, are by no means so reliable as chemists have been in the habit of assuming, and quantitative comparisons are only of value within narrow limits and when the conditions of the tests are made strictly comparable. We shall next week reproduce in the "Journal" Mr. Carpenter's further remarks on this subject.

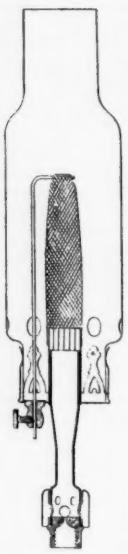
Sulphocyanide and Other Works.

At the only sulphocyanide works just now under inspection, Mr. Carpenter says the plant is of an excellent description, and all the operations are carefully conducted under the most skilled technical and chemical guidance. The sulphuretted hydrogen evolved in the course of the reactions is treated in a Claus kiln (together with other gases containing this noxious and offensive gas), with perfect success; a valuable amount of sulphur being recovered. All precautions that experience can suggest have been taken in connection with the subsequent decomposition by nitric acid of the sulphocyanide formed, from which reaction hydrocyanic acid and the lower oxides of nitrogen result. In the picric acid group of works, also, the noxious gases evolved in the oxidation of carbolic acid by nitric acid are these lower nitrogen oxides.

The report concludes with a valuable memorandum on the use of "Dolly cream" dye as a selective indicator for the detection of certain acids in gaseous mixtures, by Mr. Linder (Mr. Carpenter's Assistant), whose assistance, as well as that of the several District Inspectors, is acknowledged in appreciative terms. Their duties last year were unusually heavy, as it was the first under the operation of the new Act. The initial difficulties having been overcome, Mr. Carpenter looked forward to a relief of the pressure, which would allow more time for carrying out those independent investigations which add so much value to his reports.

A NEW MÉKER INCANDESCENT BURNER.

At the Congress of the Société Technique du Gaz held at Havre three years ago, M. Vautier submitted the results of his photometric tests of the Méker incandescent burner. Since then the burner has been improved in certain details, and the latest type, which is shown in the accompanying diagram, was brought under the notice of the members of the Society at the recent congress in Paris, as briefly mentioned in the review of the proceedings which has already appeared in the "Journal." The changes made have resulted in a considerable increase of light-giving capacity. Whereas with the original burner the consumption of gas varied from 11 to 13 litres (0·39 to 0·46 cubic foot) per carcel-hour (9·6 candles), the new model requires only from 8·5 to 9·5 or 10 litres (0·30 to 0·335 or 0·353 cubic foot) to produce this light. The economy effected by the new burner is therefore more than 20 per cent. on the highest results obtained with the original model. The constancy of yield under varying pressures, which was pointed out by M. Vautier as a characteristic of the Méker burner, is equally a feature of the improved type, which does not become obstructed by dust. The burner is made in three sizes, for consumptions of 50, 80, and 100 litres (1·75, 2·8, and 3·5 cubic feet) per hour. As will be seen, the burner is used with a chimney having air-holes. M. Méker did not give in his paper any results of trials of his improved burner, but he furnished at the meeting the following particulars of tests recently carried out with the 50 and 80 litre sizes at the Laboratory of the Conservatoire des Arts et Métiers :—



Burner.	Pressure in Millimetres.	Consumption per Hour. Litres.	Mean Horizontal Intensity. Carcels.	Candles.	Consumption per Carcel-Hour. Litres.
50-litre	53	49·00	4·460 =	42·8	11·00
	36	47·80	4·480 =	43·0	10·65
80-litre	53	79·36	9·070 =	88·0	8·75
	40	68·00	7·080 =	68·0	9·60
	35	77·60	8·715 =	83·8	8·90

At the request of the President (M. Coze), M. Méker intends to study the effect of using with his burner chimneys having holes and he will present the results at the next congress.

Proposed "Bulletin of Abstracts" for the American Gas Institute.—A few weeks ago, there was sent to each member of the American Gas Institute a circular soliciting promises of subscriptions to a proposed "Bulletin of Abstracts." Out of the 1150 circulars despatched, 225 favourable replies and 150 declinations have been received; leaving 775 members who have failed so far to state their intentions. In inviting these indifferent ones to express an opinion, one way or another, the President (Dr. Humphreys) points out that the Institute should have 75 more subscriptions if the abstracts are to be published.

Society of Engineers' "Transactions."—We have received from the Secretary of the Society of Engineers (Mr. A. S. E. Ackermann, B.Sc.) the "Transactions" for the past year. In addition to the Inaugural Address of the President (Mr. R. St. George Moore), the book contains two papers on subjects in which our readers are specially interested—viz., "Working Experiences with Large Gas-Engines," by Mr. C. A. St. George Moore, for which he received a premium of books; and "Water-Works Construction in America," by Mr. E. R. Matthews. The Society had the misfortune to lose during the year Mr. Perry F. Nursey, who had been associated with it almost from its foundation, and had served it in various capacities—of late years as Secretary. Some appreciative remarks were made by the Vice-Chairman (Mr. J. W. Wilson) at the first meeting after Mr. Nursey's decease. The volume, which contains the useful general index to the "Transactions" from 1857 to 1907, has been produced under the editorship of Mr. Ackermann.

The "Vesta-Veritas" Inverted Incandescent Lamp.—Recognizing the economy and efficiency of the inverted incandescent gas-burner for interior lighting, Messrs. Falk, Stadelmann, and Co. have been studying its applicability to outside illumination, and the result is the production of the above-named lamp. It is claimed for the lamp, which is made in various sizes, that it is absolutely wind, rain, and dust proof; and the makers state that its significant features are the perfect protection of the air intake at the port-holes of the bunsen burner from the ascending vitiated products of combustion, the creation of a well-maintained flow of pure air to the burners at the point of ignition, and the development of an increased draught by the arrangement of inner glass cylinders, in conjunction with separate metal flues to each burner. According to the particulars of the lamp which have been issued, an approximate consumption of 4 cubic feet of gas will produce a light of 125-candle power per burner. The lamps are furnished with a patent vertically burning single pilot-light, which in the case of the multiple-burner lamps acts in conjunction with a distributing flashing bye-pass.

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Sölingen	30	Potsdam	48
Ludwigshafen	30	Berlin—Oberspree	48
Zürich	100	Berlin—Mariendorf	84
Düsseldorf	70	Berlin—Tegel	10

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Elberfeld	120	Mariendorf (Repeat Order)	72
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WELLS & BOREHOLES FOR TOWN WATER SUPPLY

By H. Ashton Hill, M.Inst.C.E., Past President,

Engineer to the South Staffordshire Water Company.

[A Paper read before the Association of Water Engineers.]

In this paper it is not proposed to deal with the ancient history of the subject, or to enter into a detailed description of the various kinds of machinery and processes for sinking wells and boreholes, but rather to discuss the matter in a more general manner, especially from the standpoint of the author's personal experience.

Legal Right to take Underground Water.

It has hitherto been a common practice for water authorities to purchase land beyond that scheduled for works specified in their Acts of Parliament, and to sink for water thereon, believing that in so doing they were only exercising the common rights of landowners; but by a recent decision of the High Court (*Attorney-General v. Frimley and Farnborough District Water Company*), judgment was given restraining the defendant Company from sinking a well under these circumstances, and it was laid down that a water authority must obtain specific parliamentary powers for each and every works they propose to carry out. This judgment has been upheld on appeal; and if it remains uncontested or is confirmed by the House of Lords, water authorities will be involved in the delay and expense of making continual applications to Parliament for necessary authority to extend their works.

Now, in considering the justice of the judgment referred to, it is desirable to estimate both the advantages of the former practice and the objections to the new order of things, so that both sides of the question may be taken into account. So far as the author's experience goes, the objections to the former condition of things have not been numerous, and the only serious one he knows of is that private wells on property adjacent to the proposed new works may be depleted without the owner having any opportunity of objecting or claiming adequate compensation. Sometimes this is not an unmixed evil, because it is well known that shallow wells are, in perhaps the majority of cases, seriously polluted; and the substitution of a public water supply to isolated houses, hamlets, and villages, which might otherwise be deferred for years, is decidedly a public benefit. Moreover, in a rural district, the rates payable on a large pumping station generally form a valuable asset to the local authorities concerned. On the other hand, the author is quite prepared to admit that in some cases the depletion of a private water supply involves injury, for which the property owner cannot, as the law stands, obtain adequate compensation. At the same time the author contends that water authorities should not be unnecessarily handicapped in the carrying out of the duties and obligations imposed on them by Parliament to maintain a supply of pure water under pressure throughout their district. In many cases, particularly in very populous districts, it is inevitable that in course of time the whole of the available underground water will be required in order to maintain an adequate supply for the population within the parliamentary area. There are also many cases where the works are far removed from any private wells, and no damage can be done to anyone, whereas, it is possible that, by draining swampy ground, a water-works may be the means of vastly improving the surrounding land for agricultural purposes, and, in the neighbourhood of collieries—by removing the weight of water above the coal measures—mining would be rendered safer and more profitable. As matters now stand it would, in all such cases, be necessary to go to Parliament; and the opportunity thus afforded for all sorts of opposition can only result in a serious increase of the cost of supplying water, which will prove a great and unfair burden, unless Parliament is prepared to allow an increased scale of charges to be made to consumers. In the author's opinion it seems only right the interests of shareholders or ratepayers should be equitably safeguarded.

Geological and Meteorological Conditions.

The most important formations from which potable water is obtained in England and Wales are, as is well known, the Chalk, the Lower Greensand, and the Keuper and Bunter of the Triassic system. Water is also obtained from the Oolites, the Millstone Grit, the Permian, and a few other less important formations. The author, however, proposes to confine his attention to the Triassic formations, although much that follows will no doubt apply equally to others.

The first thing to be done is, obviously, to find the most suitable site for obtaining water, and this is to be sought, as an old geological friend puts it, by "going where water is." The selection of a proper site for boring is an important matter, on which the success of the entire venture depends, and which requires a knowledge of the geology of the neighbourhood. The physical contour of the land, the strike and dip of the strata, and the direction and extent of faults, if there are any, should also be closely and carefully studied. In this investigation, it is highly desirable that the water engineer, no matter how competent a geologist he may be, should be assisted by a professional geologist; the combined knowledge of the geologist and of the engineer being essential in locating the most suitable site for the works.

The outcrops of the water-bearing strata should be first mapped out, and the superficial area calculated by means of a planimeter or graduated squares. Sections, both parallel with and transverse to the dip of the strata, should also be made, as far as possible, from the available information obtained from existing wells, or rock exposures in quarries, railway cuttings, &c.

To compute the probable yield of a well, it is necessary to take the annual rainfall on the outcrop, remembering that one inch of rainfall equals 22,623 gallons per acre. This, multiplied by the total annual rainfall and by the number of acres in the contributing area, gives the total volume of rain falling on that area; and after allowing for "run-off" and evaporation, according to the nature of the strata, the amount of percolation represents the available supply. This is usually about 10 inches in the new red sandstone, and represents a yield of, say, 400,000 gallons per day per square mile of outcrop. In the South Staffordshire district, the average annual rainfall is about 23 inches.

An exact computation is almost impossible, owing to the existence of fissures, faults, and springs, the flow in which cannot be gauged.

In fixing upon a site for a pumping station, it is generally unnecessary to be particular to a few hundred yards, and therefore advantage may be taken of any convenient railway or canal that may be available for the conveyance of building materials and coal to the works. The site should also, if possible, abut on a public road, so as to avoid the necessity of obtaining a way-leave for the pumping main.

One is often met with the question as to whether wells show signs of falling off in yield in dry weather. The author has never found that the yield of a well suitably placed has appreciably varied. This is no doubt due to the fact that sandstone forms an underground reservoir which supplies a reserve to compensate for the water abstracted at the well in dry weather, the subsequent rainfall simply filling up the rock until, as in many cases, the surplus passes off in streams.

The theory that in process of time the supply from a well or borehole in sandstone formations gradually diminishes, owing to the pores becoming clogged is, in the author's opinion, untenable. His experience rather shows that in sandstone (unless the underground reservoir of water is being permanently depleted), as well as in chalk, though perhaps not to the same extent, the flow of water actually increases as time goes on—a result no doubt due to the opening out of the fissures. This is particularly the case when any appreciable amount of sand is drawn in by the pumps.

In all cases of well-sinking or boring it is very desirable that a diary recording the daily progress, also a core-box with specimens of the rock passed through should be kept. It is also useful to record particulars as to the flow and level of the water—particularly when other wells are likely to be sunk in the same district at some future date.

There is an apparatus now being made in America which makes it possible to obtain a continuous photograph of the strata passed through. The apparatus consists essentially of a specially constructed camera encased in a watertight iron tube. In a separate compartment of the same waterproof tube is fixed a 10-volt 5 candle-power electric lamp, the light from which is directed on to the strata to be photographed. The whole mechanism is suspended from the surface by a wire cord, by which it can be lowered and raised as required. Exposures are made by switching on the light for a short interval. It is claimed that a length of 24 feet of the borehole walls can be photographed by this apparatus in one hour. There is no doubt but that this apparatus if

successful would prove most useful in obtaining exact information as to the nature of the rock passed through.

As to the effect of pumping on streams and neighbouring wells in the New Red Sandstone formation, it is often quite erroneously assumed that the permeability of sandstone in any particular district is uniform; but this is contrary to the author's experience. Where the surface and subsoil are composed of loose pebble beds the rainfall will be rapidly absorbed by the strata, whereas if the upper strata consist of conglomerate of a very hard character, or where there are marl beds interposed, the bulk of the rainfall will be carried away by surface streams. Cases have been known to the author where the yield of wells and boreholes sunk in close proximity has been very different, the pumping level standing much higher in the one than the other. It is obvious that the sources of the supplies in such cases are different, and this is borne out by the variations in the chemical analyses referred to later on.

In the case of a new colliery in the South Staffordshire district, the quantity of water to be dealt with at one shaft did not exceed half-a-million gallons per day, whereas in a second shaft, 2½ million gallons per day were met with; and in order to obviate the expense of proceeding further with this shaft, a third shaft was put down near to the other two shafts, and in this only a comparatively small quantity of water was met with.

Another case in the author's knowledge was where two shafts within about half-a-mile of each other yielded large supplies of water, while a well sunk mid-way between the two shafts yielded practically no water. No doubt similar cases are familiar to the members.

In connection with the South Staffordshire Water Works, there is a rather remarkable heading 4 miles long, connecting impounding reservoirs in two catchment areas with a pumping station. This tunnel or heading is driven throughout its whole length in the New Red Sandstone, and besides conveying the water from the reservoirs, also yields 2 million gallons daily. The cost of this tunnel was £45,562.

Speaking of heading driving, mention may be made of one started by the author's predecessor and finished by him, some 800 yards long. This heading was intended to be driven in the rock above the coal measures; but owing to the dip of the coal seams and an anticline, the heading got into them, and though work was carried on mainly by means of "Davy" lamps an explosion occurred and two men were injured—fortunately, not fatally. The author mentions this to indicate one of the contingencies that water engineers must be prepared for.

It would not perhaps be right to leave the subject of selecting sites for wells and borings without a passing notice of the "water diviners." While quite aware that several eminent men have expressed their belief in them, the author is obliged to confess himself as a sceptic. At any rate, he feels perfectly safe in recommending the engineer to prefer a geologist for a companion rather than a diviner, especially in looking out for a large public supply yielding (say) 2000 gallons per minute. There do not appear to be any records of diviners having tackled cases of this magnitude.

Analytical Conditions of Underground Water.

It is hardly necessary to point out that it is undesirable, especially on sandstone outcrops, that the well should be situated in an inhabited district, or one that is likely to become so; and on no account should it be situated near a sewage farm or deposit of refuse, either at present in use or even if disused, or any chemical works, cemetery, or the like. The surrounding district should be thoroughly well inspected, and inquiries made of residents in the vicinity, if any. In this way, one may learn that a certain much-used dumb well or cesspit at a neighbouring mansion has never been pumped empty, nor does it ever require pumping, owing to its non-watertight construction; and information of this character is quite as important as the analysis of the water.

Samples of water should be taken from all the available wells in the district and analyzed, while the depth of all such wells (usually very shallow ones) should be noted. It is almost certain that if a well or borehole be made in the immediate neighbourhood of these wells, sooner or later one will draw off such supply, and a record of this nature comes in useful should any difference be noted later on in the composition of the water pumped. The probability of canals leaking must not be lost sight of, as frequently canal water, though remote from any source of pollution, is anything but choice, and as it travels great distances, there is every probability that the canal may communicate with a polluted river or stream at some point in its length. A well should not be sunk too near a river, unless the ground rises very rapidly above its banks, as in case of a flood, very serious consequences may arise owing to polluted water getting into the well. In fact it is a dangerous proceeding to sink a well anywhere near the bed of a polluted stream or river, as any slight disturbance of the river bed may cause leakage downwards into the strata below.

In considering chemical analyses of water, the following practical notes may be interesting and useful. In districts near the sea coast or near brine wells, the presence of chlorine as sodium chloride is no indication of pollution; and the taste of the salt may be the only bar to its use for a supply. But the action of chloride of magnesia in forming hydrochloric acid when under pressure in steam-boilers makes it a very dangerous constituent of water required for this purpose. Much albuminoid ammonia must always condemn a water (·01 part per 100,000 is quite as much as should be allowed). If the albuminoid ammonia be low or absent, nitrogen as nitrates (if no nitrites are present) may be allowed to be as high as two or three parts per 100,000, provided the water is constantly subject to chemical and bacteriological tests, and provided, of course, that there are no other indications of a possible sudden pollution, such as a rapid change in chemical composition, in which case, the water had better be rejected if any other and better supply is practicable.

The presence of free ammonia may be due to the reduction of nitrates, to the extent of from ·006 to ·01 part per 100,000; and if the water is otherwise excellent, the author sees no reason why it should be looked upon as injurious or even as suspicious.

If a water is found to vary in composition or to show signs of biological growths, it is very important to trace the flow back to its source through the agency of some harmless aniline colouring matter, such as fluorescein. But as consumers would no doubt have their suspicions aroused should they perceive any such colouring matter in the water, the author prefers the use of lithia salts, which, although giving more trouble, and being more tedious to use, will generally prove as efficient for the purpose in view.

The analyses of water taken from the main will sometimes vary in an extraordinary manner. This is not necessarily a cause for anxiety, even though the chlorine, for instance, may jump up from one to two parts per 100,000 in a short time. This amount of variation has sometimes been found in the water from two or more adjacent boreholes.

The following table, giving the proportions of chlorine and nitrogen in the water delivered by three different pumps (each working in two borings) at one pumping station, will well illustrate this point:—

Parts per 100,000.

		Chlorine.	Nitrogen as Nitrates.
Pump No. 1.	No. 1	3·6	·28
	No. 2	3·4	·25
Pump No. 2.	No. 3	3·75	·27
	No. 4	2·50	·136
Pump No. 3.	No. 5	2·25	·081
	No. 6	1·90	·117

In another case of four adjacent boreholes, the results were as follows:—

Pump No. 1.	No. 1	4·0	1·000
	No. 2	3·6	·950
Pump No. 2.	No. 3	3·5	·720
	No. 4	3·1	·680

The rate of pumping also makes a difference to the quality of the water and affects the hardness, though there is no rule as to whether the quality is affected adversely or otherwise by increased or diminished rate of pumping. In some instances, water has become considerably harder by increased rate of pumping, and in others quite the reverse.

The site for a pumping station having been determined upon, a sample of the water first tapped should be taken, and examined both chemically, biologically, and bacteriologically. Further samples should also be taken at short intervals as the well sinking or boring progresses, especially during intervals when boring operations are suspended. Experience has further shown the desirability of passing a portion of the water through a tank, to test the behaviour of the water under the influence of light and air, and in contact with iron and lead in the pumps, mains, and services.

When the boreholes and wells are finished and in regular working, analyses should be made at frequent and regular intervals, in order to show whether any polluting matter is being drawn in with the water.

One is sometimes asked as to the effect of depth on the quality of water; it being presumed that the greater the depth, the purer the water. But this is not universally the case. While in most cases the organic purity of the water is improved by its passage underground, this is not always so; and the inorganic constituents of the water vary considerably according to the nature of the rock through which the water passes on its way to the well.

It is not always the ground immediately adjacent to a well that is the first to be drained; for it is possible that the upper layers may be supplied by springs or fissures at a distance, while the lower parts of the well may be supplied by fissures from the ground nearest to the well.

In one case, the author knows of two wells within 20 feet of each other which gave quite different analyses, and in the case he has already referred to, where six boreholes situate within a space of 110 feet by 20 feet all show varying analyses, thus proving that the rocks contributing water to these different wells and boreholes do not lie in the same area or direction.

In colliery districts much water is pumped from the mines, and such water is generally quite unfit for either domestic or trade purposes, being impregnated with iron oxides, &c. The author has analyzed the water discharged from a large number of collieries, and has always found it very impure, not only because of its mineral constituents, but also through organic pollution from the men and horses working in the pits. The South Staffordshire Mines Drainage Commissioners pump 9 to 10 million gallons of water per diem from the coal measure, the whole of which is unsuitable for potable purposes.

The water is not, however, wholly useless. It is used in condensers, and for cooling purposes in gas-engines, and it is also used for supplying the canals of the district. This last is an important use of the water, as the Commissioners' works are situated at the highest levels of the Midland canals.

Relative Merits of Wells and Boreholes.

No general statement can be made as to a well being better than a borehole, or *vice versâ*. Each site requires to be considered according to the local conditions. Circumstances may necessitate wells, either with or without headings, or may permit of boreholes or may suggest the combination of wells and boreholes.

Speaking generally, where the water-bearing stratum is not of great depth, a well is preferable, in that it enables headings to be driven if it is necessary to increase the yield of water. A well has also the advantage of allowing large pumps to be installed with facility for access to them.

In one case within the author's knowledge, the yield of a well 124 feet deep, having a borehole carried through the Triassic formation into the Permian beds, yielded a million gallons per 24 hours. Feeling confident that there was a great deal more water to be obtained from the site, the author recommended the making of a borehole at the limits of the land belonging to the Company, at a distance of 260 yards from the well. An 18-inch borehole was sunk to a depth of 216 feet, through the whole of the water-bearing rock. A 15-inch pump was inserted in it, and worked continuously for 14 days; the main well being also pumped at the rate of 940,000 gallons per 24 hours during the whole time. Careful measurements of the water-levels were taken; and it was found that pumping from the borehole at the rate of half-a-million gallons per day did not reduce the yield of the well in the slightest degree, and, moreover, the pumping level in the borehole was 38 feet above that in the well. It was thus proved that for some reason or other the water in the sandstone surrounding the well was only partially tapped. A heading was therefore driven from the bottom of the well. Several fissures were cut, which yielded much water, and by the time 200 yards had been driven, the total yield of the well was increased from 1 million gallons to 2 million gallons per day. It was clear from this that water had been passing underground along the fissures and past the well.

Where, however, the water-bearing rock is several hundred feet in thickness, boreholes may be adopted with great advantage; and where large supplies are required, it is a common practice to put down the boreholes in pairs, about 20 feet apart.

One advantage of the borehole over the well is that no pumping is necessary while the work is in progress. In many cases there is great difficulty in disposing of the dirty water pumped during sinking; and where marl is met with in sinking, the water will be very objectionable and cause grave complaints on the part of riparian or other owners having rights in the streams into which the water is discharged. The chief advantage of the borehole system is that boreholes can be constructed at less cost than wells; but another important advantage is that the pumps can be put down a considerable depth (say, 300 feet) in order to command a larger supply of water.

When boreholes have to be lined with tubes, their economy as compared with wells is not so marked; and the author has for the most part taken the risk of dispensing with lining-tubes in the boreholes he has carried out, and so far has not experienced any difficulty.

In some cases it is convenient to put one or more boreholes at a distance from a well and to drive headings to them, so that the whole supply can be dealt with by one set of pumps.

Notes on Construction.

With regard to the actual carrying out of the work, the methods adopted must, as in other branches of engineering, vary according to the nature of the strata and the quantity of water expected to be met with. For instance, in soft or only moderately hard rock of close texture, and where the diameter of the boring does not exceed, say, 18 inches, the diamond boring tool can be used, which has the advantage of giving cores of the strata passed through. But in conglomerate it is better to use the ordinary chisel. In some cases, the use of chilled shot and a saw-edge tool produces excellent results in regard to speed and the preservation of cores. When sinking wells in soft and water-logged strata, resort may be had either to the freezing method or the Kind-Chaudron process; and the steining may have to be carried out with iron tubbing. But the author has, fortunately, not had to have recourse to any of these special methods, but has adopted the usual process of digging, using wedges, picks, and sometimes blasting, in hard rock. Brickwork in cement mortar is usually sufficient for lining wells in the New Red Sandstone.

In all cases it is necessary to make sure that surface water is properly excluded; and it is sometimes stipulated by the landowner to what depth the watertight lining must be carried. Fourteen-inch brickwork in cement will usually be sufficient for this purpose; but as an additional precaution it is a good thing to build two walls of brickwork, and fill in the cavity between them with fireclay.

In cases where a supply of good water is met with some distance below the surface, and yet above the normal water level, it is desirable to form a "garland" ring or trough to collect the water and prevent it splashing about the well; the water being carried down a pipe to the bottom of the well, or at any rate below the normal water level.

In cases where a borehole scheme has been decided upon, the author's practice has been to put down one borehole about 30 inches diameter for 300 feet, and then to continue with an 18-inch hole at the bottom for some 200 feet or more below that, according to the thickness of the water-bearing strata—the pump being placed on a cast-iron stool at the bottom of the 30-inch boring. The upper portion of this latter having been first excavated, cast-iron tubbing, 3 feet diameter (internal), is inserted down to the solid rock; the space round the tubbing being afterwards filled with concrete in order to exclude surface water. The top of the cast-iron tubbing is provided with a turned flange which serves to carry the pump trees.

Where there is little doubt as to the sufficiency of the supply of water, the first borehole may be put down on permanent lines, as a trial boring would cost but little less and would serve no useful purpose. The cost of carrying out a borehole such as that above described amounts to about £1600.

It is usual in borehole specifications to require the hole to be quite perpendicular; but it is not always possible to achieve this, and therefore some latitude should be allowed. It is most important that the portion of the borehole where the pumps are fixed should be as straight as possible; and it is a good plan to make this of ample diameter so as to allow for some little deviation from the perpendicular. The author has on several occasions had to deal with crooked holes, and has got over the difficulty either by filling up the

crooked part with brick-bats or similar material and re-boring, or by enlarging the boring from the top. It is, of course, necessary to test the verticality of a borehole from time to time as the work progresses.

In practice, the diameter of a borehole is chiefly governed by the dimensions of the pump as regards the upper portion, and by the quantity of water required as regards the lower portion. Having formed some idea of the probable yield of the boring, the size of the pump can be decided on, after which it is a simple matter to decide upon the diameter required to accommodate it.

The much greater cost of well-sinking as compared with boreholes is well illustrated by the case of a well carried out by the author many years ago. The sandstone was in parts of so soft a character that the sides feli in, and as some two million gallons of water per day (*plus* sand) had to be pumped, the difficulty and cost of the work were very great. The design provided for the fixing of the pumps some 150 feet below the surface; and it happened that at this point the rock was little better than running sand. It was necessary to build large chambers in Staffordshire blue brick and cement to hoid up the sand; and, as may be imagined, the well proved costly.

It is sometimes feasible to increase the yield of an existing well by driving a borehole from the bottom of it; and this can be done without interfering with the use of the well for supply purposes. The method adopted by the author was to drill a hole for a few feet, and then insert a lining tube (with or without a valve on it), which could be continued to the top of the well, and the boring tool worked through it.

In testing the yield of water from wells or boreholes, it has been the author's practice to utilize the contractor's boring plant, and to specify a pump to lift half-a-million gallons per 24 hours, working continuously for a fortnight. But this test is not quite satisfactory, and the author intends in the next scheme he carries out to specify a test of not less than 1,000,000 gallons per day; and he proposes, where the hole is deep enough to allow for sufficient submergence, to specify the use of an air-lift plant for the purpose. The most convenient method of measuring the water-level in a boring is by means of a pneumatic gauge connected to a small copper tube carried down between the pump and the lining tubes to a known depth. The pressure for working the gauge is obtained from the air-vessel or a small hand pump is provided by which the air can be expelled from the copper tube, when the pressure indicated on the dial will show the level of the water in feet from the engine-house floor.

Whether a well is ultimately constructed or not, it is in most cases desirable to put down a borehole in the first instance, in order to avoid the risk that, after sinking a well for a considerable depth, possibly through very hard strata at considerable cost, the yield of water may be so small as to be altogether out of proportion to the amount of money spent on the well. This is particularly necessary where one is operating in strata of which no positive data are available; and if the test for yield is made by an air-lift pump this trial hole need not be very large in diameter, and consequently the cost will be small.

With regard to the question of carrying out boreholes and wells by administration or by contract, the author's view is that, at any rate in the case of boreholes, it is much wiser to let the contract to one of the many competent firms who specialize in this class of work.

With regard to specifications for boreholes and wells, great care is necessary in order to provide for the many contingencies that may arise, more especially in well-sinking. The nature of these depends very much on the strata and the quantity of water met with. Whereas in the case of a borehole the only contingency is as to whether the hole will want lining or not, which can easily be provided for in a schedule of prices, in the case of a well, many other risks are involved, and for this reason perhaps it may be preferable to sink wells by administration rather than contract. In a mining district, there is no difficulty in obtaining experienced sinkers to superintend the work. Although specifications should state the character of the strata to be passed through as far as known, the contractor should be compelled to satisfy himself on the point and be held responsible for any variation that may be found. A schedule of prices for boring at per foot for each successive 100 feet or part thereof should always be given with the tender; also prices per hour for the various classes of labour and per foot run for any solid or perforated lining tubes that may be required. The price quoted for providing and erecting test pumps should include the cost of carriage and all incidental charges; and prices for the hire of pumping plant, and for working it at per day of 24 hours should always be given separately.

In cases where, after some years' regular working, the yield of water is fully maintained, and the pumping level of the water is not far below the surface, it may be safely concluded that an additional quantity of water could be obtained from the site if required. But in calculating the size of the additional pumping machinery to be installed, the engineer should always consult a geologist, because if a larger scheme should be proposed than is justified by the conditions of the gathering ground, it would mean that in the course of a few years the machinery would be too big for its work, and economical working would be impossible.

The author has refrained from discussing the various types of machinery used in pumping from wells and boreholes, because this subject has been dealt with at previous meetings of the Association.

[The paper concluded with some examples giving actual costs of wells, headings, and boreholes carried out by the author under varying conditions, and which he hoped would prove useful to members, and would no doubt be supplemented in the course of the discussion.]

Discussion.

Mr. H. Preston, F.G.S. (Grantham), said he had been very pleased, while reading through the paper, to notice how full it was of the author's own experiences. It was this class of information which led to accurate knowledge. Early in the paper, the author said: "The amount of percolation represents the available supply." This, in theory, was correct when the rocks were fully charged; but practically there were many reasons why a certain well should receive more or less than its normal quantity; that normal quantity being the yield of the theoretical area drained by the well. The texture of sandstones varied according to their manner of being formed; and sometimes a coarse-grained porous bed, deposited in a wedge-shape, might carry the water to, or away from, a well in quite a perplexing manner, and make its yield vary greatly from its normal quantity. Of course, this often occurred in fissured rocks. They might miss a fissure, and get less than the normal, or they might strike a fissure, and get more than the normal; so that the author's friend was right when he said "we must go where the water is." As to wells falling off in dry weather, the rest-level of the water undoubtedly did vary with the weather; but if a well or boring was placed in an exceptionally good position, the proportion of water which it yielded, compared with the whole storage underground, was so small that it was not perceived. If, however, the underground storage was being drawn on largely, then seasonal variations would show themselves in the well. The author had touched on a very interesting topic where he referred to the supply from a bore-hole in a sandstone formation gradually diminishing. He (Mr. Preston) imagined that this would be dependent upon what minerals the water contained when it reached the sandstone. They knew very well that rain-water passing into certain rocks very quickly took up mineral ingredients; but they did not know sufficient about the behaviour of such mineral-charged waters as they passed through the various rock formations. It was quite conceivable that what a water took up in one class of rock, it might, under certain chemical and physical conditions, be led to deposit in the interstices of another rock; and thus, under certain conditions, a sandstone supply might decrease after long use. For instance, a pure sandstone underlying a calcareous rock might at first yield a good supply; but if the interstices between the sand grains became filled with lime deposits, it might be changed into a dense calcareous sandstone, which yielded little or no water. He should like to emphasize the author's remark about the desirability of keeping specimens of rocks passed through when sinking for water. The use of such specimens was not yet fully understood. When rock specimens were more carefully examined, both chemically and physically, they would know more about the quality and the yield of the underground water supplies. The author had referred to the geologist. There was no doubt it was always desirable to have a geologist to watch a boring, even though he did not advise as to the best position to bore, because he could often prevent a big waste of money by stopping a boring as soon as it got into a formation from which he knew it was practically impossible to obtain water.

Relative to putting down boreholes in close proximity to each other, it might happen, as the author pointed out, that they struck different sources of supply; but it was not good practice, unless the underground storage was known to be very abundant. He (Mr. Preston) knew a case where an 8-inch boring was put down through the oolites, and an excellent supply of water was obtained. This was not quite sufficient for the purposes required, so another 8-inch boring was made about 12 feet away. Upon testing the two artesian supplies, separately and combined, the yield was just the same. Evidently the first boring had struck a fissure, the full supply to which was measured by the flow from that boring; and the two holes could not get any more from the fissure than was coming into it. Ultimately a third boring, put down 80 yards away, solved the difficulty, by doubling the supply. In the paper, a heading was mentioned as having been driven through the New Red Sandstone for a distance of 4 miles; and it increased the daily supply by 2 million gallons. During the driving of this heading, there would be an excellent opportunity to study how the sandstone yielded its water. Was it from the interstices of the rock; was it from the less compact or coarser veins of sand or pebble beds; or was it from fissures? And also, what was the relative value of headings compared with borings in the New Red Sandstone? His own impression was that the yield was not from fissures but from the more open veins of sand or pebbly beds; and if a well yielded (say) a million gallons, then headings did not increase the supply to any great extent —at least they were not of the same value as in fissured rocks. The cone of depression caused by pumping a well would not be much extended by driving a short heading. The great benefit of headings was to connect wells which drew on different cones, and to form an underground storage. The author gave a passing thought to the "diviner." He (Mr. Preston) had had quite a number of experiences with "water finders;" and though in some cases he was puzzled, he was quite convinced that, in many instances, there was a great deal of humbug.

Mr. William Matthews (London) said there was one point in the paper that was noticeable. It had puzzled him very much; and he should like Mr. Hill to give some more information concerning it, to see whether he had followed the matter any further. The paper included some most remarkable results in connection with the analyses of the water from a number of boreholes which had been pumped from at the same pumping-stations. No. 1 pump pumped from two boreholes, and so on; and he assumed these pairs of boreholes were not more than 20 to 30 feet from one another. Yet the analyses were different. What he should like to ask Mr. Hill was, whether the analyses were of water on any one particular day, or were they the net result of permanently using the boreholes and systematically making analyses. If the analyses were the result of only one day, he should, without knowing who made them, be a little dubious as to their value. But if they were the result of a continuous record, and were the averages, it would be an extraordinary state of things. Then, again, with such a thing happening, one would be certain to follow it up; and it would be very interesting to know whether Mr. Hill had followed the analyses up by at the same time having bacteriological examinations made. The analyses in his (Mr. Matthews's) opinion created a great deal of suspicion; and he should have been inclined to carry them much further than was shown in the paper. The only other question was as to sinking by administration or by contracting. In many respects, he (Mr. Matthews) had been in favour of the work being done by administration where everything was perfectly straight. But when they came to well or subaqueous work, and where risks had to be run, and where a large amount of work was involved, there was only one thing to be done, and that was to go boldly to some first-class firm who had ample equipment for their work, and arrange with them to do it—not on a specification making the firm take all the risk and the water authority only paying a fixed price, but on equitable terms; so that, if difficulties which nobody could foresee had to be faced, those who benefited from the work should pay a proper amount.

Mr. T. Molyneux (Stockport) said he had experience somewhat similar to that of Mr. Hill in connection with his boreholes. He had two boreholes within twenty yards of each other. The first one was only shallow—about 200 feet deep; the second one was 600 feet deep. In the water of the second, iron was found, which iron was precipitated on exposure to the atmosphere. Then they filled in 150 feet of the hole. Still the iron was present; and a water-softening plant was put down to remove it. The 200-feet borehole had now been lowered to 450 feet; and though it was only 20 yards away from the other one, there was no sign of iron in it. It was most extraordinary, and they could not account for it. But there it was.

Mr. J. J. Lackland (St. Helens) remarked that the paper gave some admirable details, which could not but prove valuable to those who had to do with boreholes. There was one point that occurred to him; and it had reference to the generally accepted statement that about 10 inches of percolation might be regarded as the quantity of water available for supply in the New Red Sandstone. That might be so when the sandstone was bare at the surface, as he believed was the case in Nottinghamshire; but in Lancashire, where they had from 2 to 22 feet of boulder clay, it ceased to be a reliable guide. He believed it had been pointed out before by one of their former Presidents (Mr. Bancroft) that in the case of the chalk where the boulder clay was absent not more than 4 inches of percolation could be relied upon for the underground supply. That was reported as substantially correct for dry years by the Royal Commission on the Metropolitan Water Supply of 1892; and it was certainly an element to be taken into consideration. It was almost impossible—he would go farther, and say it was quite impossible—to make a computation of the water supply to be obtained from any particular well or borehole in any particular district, because, as the author pointed out, fissures had such an important bearing on the matter, especially in the New Red Sandstone, from which fissures probably the greater part of the supply was obtained in many wells in this formation. He himself had a well in which there were fissures—horizontal ones mostly—in which a man could put his head, so that they were not mere cracks in the sandstone, but absolute cavities, which extended for a considerable distance, and afforded very ample carrying room for water. With some of these wells in Lancashire, exhaust pumping had been continued for a long time, and by many years of pumping—say, 20 years—the water-level had been lowered to the bottom of the wells; and the decrease of the supply still went on until there was an absolute decrease in the quantity obtainable. Formerly, these wells gave them up to 1½ million gallons per day for each well; but the supply was now gradually diminishing, though at a slow rate. In another case of which he had experience, the well was 225 feet deep, and the total depth of the borehole 400 to 500 feet; and the supply there had decreased to the extent of nearly one-half. In 1871, when the works were started, there was available from that well and borehole some 800,000 gallons per day or possibly 1,000,000 gallons. It was now diminished, and had been in recent years, to 450,000 gallons a day. These facts showed the great uncertainty which existed in connection with the quantity of the water supply from wells in the New Red Sandstone. There was one other statement by the author to which he should like to refer—that was as to apparatus now being made in America for photographing the sides of boreholes, he presumed under water. He (Mr. Lackland) had had experience of a case where a contractor dropped a pump down a borehole; the pumps were 200 feet in length, and the borehole 560 feet deep. The hook of the lifting tackle broke, and the pump fell, leaving 360 feet of water above the top of the pump. In order to recover the pump, an attempt was made to photograph 360 feet down the borehole, which was full of water, so as to obtain particulars as to the position of the pump. Considerable expense was incurred in the trial, and some time occupied. An electric light was used; the photographing apparatus being specially constructed, and it was lowered down the well. But there was absolutely no result, and no impression whatever on the plate was produced by the operator. He mentioned this to show that, in his opinion, there was considerable uncertainty as to this sort of apparatus. As to the general advisability of sinking boreholes and wells in uninhabited districts, or in parts of the country where no land cultivation existed, this was a very enviable position, and one which could be wished for from every point of view. But in the locality from which he came, there was no choice in the matter. They had put down boreholes and wells in areas inhabited by a scattered population, and in which the land was cultivated in a very high degree. The effect on the boreholes was absolutely imperceptible from the analytical and bacteriological points of view—possibly owing to the general coating of boulder clay over this part of Lancashire appearing to afford efficient protection against pollution.

Mr. F. W. Hodson, M.Inst.C.E. (Loughborough), said there were a few remarks he should like to make regarding the eminently practical paper by Mr. Hill. With respect to the legal position which had been brought prominently forward by the case of the *Attorney-General v. Frimley and Farnborough Water Company*, he must say that he thought it was in the general interests of the community that this decision had been given. Mr. Hill's experience, that there was little objection to the former practice, was no doubt due to the fact that he was in a most favourable position, in that his very extensive water limits included all the populations dependent on, or having rights in, the sources of supply, as well as the water-bearing area from which the supply was derived. But there were many cases—for instance, in the Nottinghamshire area—where the limits of supply did not include the area from which the water was obtained, and other populations that were dependent upon the sandstone as their only source of supply; and the source of supply was therefore liable to be raided by other authorities who had need of water, but not so much right to the supply. If it were possible, by simply taking power in an Act of Parliament to purchase 20 acres of land, and then to purchase it in that area, put down a well, and abstract the water without specific powers, and without the possibility of opposition, it would be very detrimental to the interests of those districts which had prior rights in the supply. The only safeguard to the rights of other authorities was that a Parliamentary or a Local Government Board inquiry (at which all interests could be heard) was necessary before a water supply could be obtained; and this safeguard should be jealously maintained. He was glad to observe that Parliamentary Committees had recently adopted this view. Mr. Hill, in setting out the principal requirements necessary for the selection of a proper site for a well, had omitted the one which was probably the most important of the whole, and the one which it was the most difficult, or even impossible, to determine—that was, the natural direction of the flow of underground water, and the area from which it came, to replenish the supply. If they were only able to determine the limits from which water naturally flowed to a site, and if they were only able to determine the direction of that flow, water supply from underground wells would be an exact science, instead of what it was now—the empirical result of wide practical experience, aided to some extent by good fortune. The flow of underground water in the New Red Sandstone was determined to a great extent by the direction in which the rain which had fallen on the area for ages had been forced to take in finding its way to the sea. With regard to Mr. Preston's statement that fissures were not advantageous, his (Mr. Hodson's) experience was entirely opposed. In inspecting the headings of many water-works wells, one was struck by the fact that, in the New Red Sandstone, the bulk of the supply was obtained from bleeding or filtration from the rock; and he looked upon the fissures in the well as an additional area of headings, which one got free of charge, and without any detrimental effect on the quality. To a considerable extent, the total yield and the permanence of a well in the sandstone could be gauged by the superficial area of sandstone exposed in the well and headings, considered in relation to the hydraulic pressure which could be brought to bear on the different portions of the area by pumping down the water in the well to a certain level. With respect to the yield varying according to the weather, he thought there was no doubt that, either in a large or in a small well, whether it was being pumped on up to the capacity of its site, or whether it was being pumped on to a lesser capacity, the actual rainfall year by year did have a very marked effect on the available yield, which could be traced if the records were correctly kept. He had an interesting experience of that at one of his pumping-stations where they kept a permanent clock recording the water-level in the well from minute to minute throughout the year.

Mr. Neil M'K. Barron (Lincoln) said that there were one or two matters to which he should much like to refer. The first was touched upon by Mr. Hodson, who had alluded to the situation of wells topographically. Suppose for a moment two extreme cases. Take a well sunk on the top of a hill, and one sunk in a valley; each well being of the same depth. The well sunk on the top of the hill would receive the water from the rain falling on the cone of exhaustion only, but the well sunk in the valley would receive not only the rain that fell on its cone of exhaustion, but also rain that fell outside the cone of exhaustion. The difficulty could be overcome by sinking the well on the top of the hill deeper; but there was a decided advantage in adhering to the lines necessarily adopted in connection with surface water supply, and placing the wells so as to intercept in the cone of exhaustion waters from the natural watershed flowing underground. One point of Mr. Hodson's in this connection he quite realized—viz., that the line of least resistance for the passage of water through the red sandstone down to the level of saturation of the streams was in the line of the natural flow of water to the stream; but he considered the line of least resistance beneath that level must be in the direction of the dip of the strata. There was another matter to which he wished to allude, and it had reference to the analysis of the water from the boreholes. The members had no doubt all heard of the very unfortunate experience they had had at Lincoln. There a borehole was put down by Mr. Percy Griffith to the depth of some 2200 feet. The work was admirably carried out in every way; but unfortunately they met with water of over 130° of hardness. If they took the water from the outcrop of the pebble beds, they found a hardness of something like 8°; if they went 8 miles to the eastward, to Gainsborough, the hardness was 23°; while the hardness at Scunthorpe and Lincoln, some 14 miles east of the outcrop, was over 130°. The farther they went from the outcrop of the red sandstone, the harder the water was evidently bound to be. Regarding the question of obtaining a large supply by putting two boreholes together, he took it that what Mr. Hill meant was that the two boreholes, put together in the way described, would act as one well. Mr. Hill did not anticipate, by putting the two boreholes 20 feet apart, to get from each an independent supply of water, but that, by having the two holes together for the convenience of pumping, with single-acting pumps in each, he would get water as from one well.

Mr. S. R. Lowcock (London) remarked that the author stated towards the end of his paper that "although specifications should state the character of the strata to be passed through as far as known, the contractor should be compelled to satisfy himself on the point, and be held responsible for any variation found." From an engineer's point of view, he (Mr. Lowcock) thought this was excellent; but from a contractor's point of view, he did not think this was at all fair. In this connection, he had brought with him a section of a borehole he had recently had constructed; and in this particular case, it was very hard on the contractor. Apparently, a short distance below the surface, in putting down the borehole, they went through 8 ft. 6 in. of conglomerate; but when the contractor came to sink the well, they found the borehole had gone through only a little lump of conglomerate of that thickness. He gave this as an instance to show that boreholes were not altogether reliable in showing the sort of strata one was likely to pass through in putting down a big excavation. They had all had the same experience in sinking boreholes for testing the sites of reservoir dams. The author said that, in testing the yield of the water from wells or boreholes, it had been the practice to utilize the contractors' pumping plant. He (Mr. Lowcock) had done this himself; but he should like to support Mr. Hill in his recommendation to have separate testing plant put down afterwards. The testing was really important. With reference to percolation, he did not think that it was possible to form a very definite idea as to what they were going to get from a borehole by considering the amount of percolation. It was, he submitted, only a sort of basis for a guess. But it was absolutely impossible to allocate an area over which the percolation would extend, or rather from which the water would be attracted to the well. There were faults and all sorts of overlying strata that would interfere.

Mr. A. B. E. Blackburn (Sunderland) observed with regard to the Frimley case that he took it the judgment only applied to this specific authority, and was not of general application. With regard to what Mr. Hill said about the relative advantages of boreholes and wells, he (Mr. Blackburn) quite agreed with him that the chief advantages of the borehole system were that the boreholes could be constructed at less cost than the wells, and that the cost was saved of pumping away the water when sinking a well. He did not understand the point of Mr. Hill's remark that another important advantage was that the pumps could be put down a considerable depth (say, 300 feet), in order to command a larger supply of water. The pumps could be put down to any depth in either a well or a borehole when sunk. As to the exclusion of surface water, the author said that 14-inch brickwork in cement would usually be sufficient for this purpose; but as an additional precaution, it was a very good

thing to build two walls of brickwork, and fill in the cavity between them with fireclay. This seemed to be rather unnecessary. Why not fill in at the back of the brickwork with cement grout, and so make it perfectly water-tight? The excavation was necessarily somewhat larger than the outside diameter of the brickwork; and if the annulus was filled with cement grout, that would meet the case. His experience agreed with that of Mr. Hill with regard to the inappreciable variation in the yield of wells with the inequalities of the rainfall. He had not found that the water levels in the wells in the magnesium limestone in the Durham district varied in the slightest at different seasons of the year. This matter of the yield of wells was complicated by the question of the slip of the pumps, unless the water pumped was accurately metered.

Mr. HILL, in reply, said Mr. Preston's contribution to the discussion was a very interesting one. The point he mentioned about the sandstone being overlaid by calcareous rock was exceedingly instructive. That had not occurred to him (Mr. Hill); and it showed how the lime might block up the porous rock underneath. As to the point about the pairs of boreholes, that was simply a matter of convenience for constructional purposes. When a large supply was wanted, and a sufficiently large bucket could not be used, it would not do to put the one bucket into one hole. But by making the two boreholes, with two buckets alternating—the one going up while the other was going down—suitable pumping work was realized. As to the tunnel 4 miles long, Mr. Preston wanted to know how the water came out of the rock. He quite agreed with Mr. Preston as to the value attaching to his point. But the heading was made about fifty years ago, since when no one had been up it. He himself had never summoned up sufficient courage to go up it, nor had anyone else, so that he could not give Mr. Preston an answer. As to the comparative yield from wells and boreholes, there was something mentioned about that. Of course, this was a very important point, and had to be carefully considered in each case. This was really what he wanted to imply in his paper—that there were cases where a borehole would be advantageous; but in other cases, a well would be more suitable. In each case, all the surroundings and every point had to be taken into consideration to determine which was the better. Mr. Molyneux mentioned an instance confirming what he had said. In the case of a well 200 feet deep, Mr. Molyneux had no iron in the water; but, when he went down 450 feet, he found iron. Mr. Matthews raised the question of sinking wells by administration and contract. He preferred contract work; and he (Mr. Hill) thought that, speaking in general terms, Mr. Matthews was quite right. It was not advisable for water-works engineers to take too much risk. In colliery districts, however, and where the engineer had a fair amount of practice, there was not much risk about this work. Mr. Lackland, Mr. Hodson, and Mr. Lowcock had referred to the 10 inches of percolation; and the way the last-named gentleman put it, about summed up his (Mr. Hill's) views. It was simply a basis for a guess. But, of course, they had to have something to go on; and he had used this in his own practice. What he was thinking of, in mentioning it in the paper, was a district where the figure named did come out in practice; but there were other cases where he had not got it. If, however, the circumstances of the position, and of the rocks, were favourable, it would come out all right. With reference to boulder clay districts, many years ago he had occasion to go into this question fully as to the amount of water that was to be obtained from the rocks in West Cheshire. He had full particulars; but he had to eliminate all boulder clay areas, which were extensive in that district. Of course, the 10 inches would not apply there. About the depletion of wells, Mr. Lackland spoke of thirty years. He (Mr. Hill) thought they ought to remember that they were only justified in trying to pump from a well the amount of water that was annually put into the rocks by the rainfall; and if they did this, and did not attempt to take any more, then these wells should not be depleted. It was interesting to see how the inclusion of some little feature in a paper brought out an instructive point in the discussion, as was illustrated by Mr. Lackland's experience in endeavouring to photograph a tool down a well. Mr. Hodson had spoken about going outside an area for sinking wells and so on; but in that case an Act of Parliament would be required. Then with regard to the question as to the selection of the position of a well, of course, they were not dealing here with an exact science. A great deal could be done in mapping-out the levels of the impervious floor underground, and then with the surface levels it was possible to produce to some extent, and to a very reliable extent, the direction of the flow of the water; and the nearer the plotting-out approached to accuracy, the more exact would be the position of the well. These considerations were all of them more or less theoretical. Still they had to use them as a basis, or they would not be able to put a well in nearly a right position. Mr. Barron had made some remarks about sinking wells on hills and in valleys. That was rather interesting, because in some districts they put their wells on hills, and in others in valleys; and it was really important to consider the points Mr. Barron had raised. Mr. Lowcock's experience was not unique in being misled, in sinking a well, by the strata not agreeing with the trial borehole. Regarding his (Mr. Hill's) dealings with contractors, he did not think he should be unduly hard on them. In his paper, he was rather thinking of a contractor who was putting down a borehole, and he (Mr. Hill) would be putting down the well by administration; so that the contractor would not come in in that case. Mr. Blackburn had mentioned the Frimley and Farnborough case; and he doubted whether it would apply generally. The point was would people go on putting down these wells and establish new works under such circumstances in face of this judgment. They could, of course, do so; but would it be desirable? They would lay themselves open to an injunction and all sorts of trouble. In face of the judgment, it would be necessary for everyone to get parliamentary powers for any works proposed to be carried out. As to putting wells down 300 feet. What he had in mind was this: Supposing they went into a district where there was plenty of water (say, 4 million gallons per day), if they started to put down a well in the district there would be plenty of pumping to do in making the well. They would require to have some tremendous pumps, but would probably be satisfied with a supply of 1 or 2 million gallons. At 100 feet, they might get the 2 million gallons. But if they did not go to the enormous expense of sinking the well, and instead have a borehole 300 feet, there was nothing to prevent them putting a pump down at that depth; and knowing they were in a position to pump all the pump would give, was a considerable advantage. About the brickwork in cement and fireclay; it could be done both ways. Probably as they were excavating, they would want to brick-up against the rock. To fill up, of course they could do this on the outside; but he thought it an advantage to have the filling between two walls. Respecting the measurement of the quantity of water in the wells. This was very important. The testing bore largely on the future success of a station, the size of engines, and so on. Great care ought to be exercised in testing the yield accurately.

Proposed Gathering of the Junior Associations in London.

Following the suggestion thrown out at the Joint Conference of the Councils of the Junior Gas Associations held at Birmingham early in the year, definite steps have now been taken to hold a conference of the whole of the Junior Associations in the "Congress Hall" at the Franco-British Exhibition. The date fixed is Saturday, the 29th of August; this being the only day which can be granted by the Exhibition authorities. The use of the hall has therefore been secured for that date; and fuller particulars of the proposed proceedings will be issued later on. Meantime, Mr. W. J. Liberty, the President of the London and Southern District Junior Gas Association, has been elected Hon. Secretary of the Reception Committee; and to him (Gas Inspector's Office, Guildhall, London, E.C.) all communications should be sent.

The Franco-British Exhibition Gas Section Guarantee Fund.

Mr. James W. Helps sends a further list of amounts received towards the expenses involved in the Gas Section of the Franco-British Exhibition. These latter contributions total to £223 18s. and make, with the sum already acknowledged in our columns (£3947 18s.), £4171 16s. The list now sent includes £50 from Birmingham, £25 from Dublin, £21 from Sunderland, £10 10s. apiece from Ashton, Bath, Rochester, and York, £10 each from Canterbury and Peterborough, £5 5s. each from Romford and Waterford, £5 from Guernsey, £3 3s. apiece from Bishop Auckland, Queenstown, Redditch, Runcorn, and Sutton, £2 2s. apiece from Ascot, Bognor, Felixstowe, Kilkenny, Longford, Matlock, Stourbridge, Tipperary, Waltham Cross, Wellington, and Wicklow, and £1 1s. apiece from Bagnalstown, Carrick-on-Suir, Fermoy, Frodsham, Magherafelt, Mallow, Mountmellick, Prescot, Sandown, Sleaford, and Thurles.

The late Sir James D. Marwick, LL.D., who for thirty years held the position of Town Clerk of Glasgow, left personal estate worth £57,364. Mr. F. Wells, one of the Directors of the Chelmsford Gas Company, left £119,771.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to the York Gas-Works.

Seeing that the President of the Yorkshire Junior Gas Association—Mr. J. H. Hill—is the Engineer and Secretary of the York United Gaslight Company, the usual visit to the President's works had this year been delayed until July, and combined with the summer excursion. Last Saturday, some of the members spent all day in York, while others joined them in the early afternoon; the whole muster being gratifyingly large, considering that York is not conveniently situated for most members.

The morning and evening were devoted to visiting the many antiquarian and architectural attractions of the city, and in this the members were exceptionally favoured in the matter of guides. In addition to Mr. Hill, who has lived all his life in York, was Mr. T. P. Cooper, one of the Gas Company's officials, who is practically the recognized historical authority of York, having been engaged for some thirty years in local research, which he has embodied in several published volumes. With guides so expert and enthusiastic, every street assumed unsuspected attractiveness. The members developed not only interest but enthusiasm; and the long summer day came far too soon to an end. It is little to be wondered at, then, that even the more prosaic afternoon visit to the gas-works assumed novel aspects, and had its share of antiquarian reminiscences and disquisitions ranging from the geological formation of the ground to its changes within historic times, and to the early details of the introduction of gas lighting into York.

What are locally known as the "old works" are on the site of the original works, cover an area of 3½ acres, and have a capacity of 1¾ million cubic feet per day.* The works are provided with three holders, erected in 1847, 1857, and 1867 respectively, and have a storage capacity of 240,000, 400,000, and 400,000 cubic feet. The retort-house is of ample proportions, 307 feet long and 54 feet wide. In its centre is a chimney-stack 130 feet high, and of exceptionally large proportions at the base. This and the neighbouring parts of the house were erected in 1847; and the building has subsequently been extended in both directions, adhering to the original design. Anxious for the maintenance of associations worthy of York's history and character, the local gas authorities impress upon visitors that in its proportions this chimney is a copy of Trajan's column at Rome. Across one end of the large retort-house is a mess-room; while extended across and beyond the other end is a coal-store.

In 1881, a further site of 5½ acres was obtained for extensions, which were at once carried out. The new works are divided from the old ones by a tributary of the Ouse known as the Foss Navigation, and also by a public road along its banks. Communication between the two works is effected by a high-level railway bridge, and both works are fully served with high and low level railway tracks communicating with a branch of the North-Eastern Railway Company's system. This new site Mr. Cooper has since conclusively proved, from records extending back to the Doomsday Book, to have been part of a large lake made by damming the Foss Navigation. When erecting the works, the ground was found, by excavations and trial borings, to be of exactly the character one would expect under these circumstances. So unreliable was it that, wherever a heavy superincumbent weight was expected, holes were dug and filled with concrete, so as to form a suitable foundation. Probably owing to the inrush of foul gases from decaying matter among the lake deposits, three or four men perished at the time in one of the holes thus made. On the new site, a red brick retort-house (210 feet by 110 feet), of attractive design and finish, was erected, and intended for an output of about 1½ million cubic feet per day. The house has never been completely equipped with retorts, as a carburetted water-gas plant was installed some years ago in an adjoining house. Subsequently a second and equal unit was added of the same type (the "Economical"); so that now the plant has a nominal capacity of 1½ million cubic feet per day, though it can be pushed so as to produce very nearly 2 millions.

The new house is fitted with direct-fired settings of through retorts, and is entirely let-down in summer. The old house has regenerator settings of eights, hand-charged. Some reconstruction is now going on, which will eventually give ten settings on one side of the chimney and nine on the other. Then either half will prove sufficient for the mid-summer period. The water-gas plant is really used as a stand-by, and as a means of correcting any sudden differences in the make of gas as extra beds of retorts are let-down or put on. Last year some 71 million cubic feet of water gas were supplied, out of a total of 488 millions—*i.e.*, about 14½ per cent. on an average, and at no time above 20 per cent. The two works are each completely equipped with condensers, washers, &c., and can be worked entirely independently, or gas can be passed from one into the other as may be desired.

With these two large retort-houses and the carburetted water-gas plant, the Company will easily be able to meet the maximum demands made upon them for some time to come, though they expect and intend to secure a growing demand for their main commodity. When the two original Companies amalgamated in 1844, there were 1924 consumers using 23 million cubic feet of gas per annum, and paying 6s. 8d. per 1000 cubic feet for it. In 1850, the sale was 36 millions; but by 1860 it had grown to 66 millions, by 1870 to 122 millions, by 1880 to 224 millions, by 1890 to 319 millions, by 1900 to 462 millions, and last year it reached 488 millions. This later growth seems slower; but in 1903 the North-Eastern Railway Company, who used to take about 32 million cubic feet of gas per annum, began to manufacture all their own artificial light. In addition to this, a very large local trade in coke has been built up by long-continued fostering of this branch of the business and persistent pushing advertisement. Last year no less than two-thirds of the total sale of coke was for local domestic use, both broken and unbroken, and at a price that awakened the envy of many of the members present. This outlet for coke necessitates watchfulness in the use of the carburetted water-gas plant, as sometimes it is inexpedient to use up coke in this way, and more economical to make coal gas in preference for the sake of the coke produced. In this connection, not a few of the visitors made a mental note of the possibilities opening up to a gas undertaking that utilized its most prominent boundary wall (in the present case, the one facing the Scarborough Road) for well-painted bold advertisements of coke, &c.

A rainy interval was utilized for gathering in the offices at the works and hearing Mr. Hill describe the development of his Company's operations. On the wall was a large map, prepared some seventy or eighty years ago, showing the scale of the earlier operations and the position of the mains, &c. The original main leaving the works was a 6-inch one. Both Mr. Hill and Mr. Cooper dealt with a number of antiquarian details suggested by this map, and were freely plied with questions—everyone being delighted at the novelty and fresh interest of the subject. True to Mr. Hill's well-known fondness for demonstration models, the members were introduced to a large glass working model by which he was able to make clear to them the York method of continuously removing the tar from the hydraulic main. This has been in use without any intermission for upwards of twenty years, has proved an unquestioned success, and dispenses with the need of flushing the main. It is somewhat on the principle of the well-known tar-towers generally used; or, rather, it accomplishes the same work in a simpler, more open, and therefore more accessible, fashion. The tar is taken off at the bottom of each section of the hydraulic main, wells up an open vertical pipe standing in a box (one answering for the pipes from two sections of the main), pours over in a continuous visible stream, and then flows away to the tar-main. The liquor passes over the weir-valve with the gas into the foul main, and is there taken off. Straight from the model, the members went to the top of the retort-stack to see the actual thing in operation, and further questions then came thick and fast.

In passing round the works, many features of interest were noted, such as some of the older gasholders being still counterpoised, while the largest and latest one stood in a steel tank placed above ground. Attention was called to a very large battery condenser of 18 sections and some 30 feet in height, which was pretty much a novelty to many who were present, as but few of these are found in the West Riding of York. Lime is gradually being less used in purification; and in examining the details of the purifiers, a set of circular boxes erected on the new works by the late Mr. V. Wyatt in 1881 came in for special scrutiny. These are water-luted; the lids are raised by an overhead travelling lifter, guided up standards, and then propped up. The latest boxes are of the Green type. As a journey along part of the city walls was then to be undertaken on the way to the tea-rooms, time ran short before everything was seen; so some of the more usual pieces of plant that did not present any special feature were passed by.

Subsequently the members and a considerable number of the office and other employees of the Company were entertained at tea by the Chairman and Directors at the De Grey Assembly Rooms. Mr. Hill apologized for the unavoidable absence of the Chairman and Vice-Chairman, and conveyed these gentlemen's welcome to the visitors. Votes of thanks to the Chairman and Directors, as well as to Mr. Hill, Mr. T. P. Cooper, and Mr. Watson, the Works Superintendent, who had assisted the visitors as guides, were passed, after eulogistic short speeches by Messrs. Butterfield, Demain, Shepherd, and Cranfield.

* Some illustrations of the works were given in the "JOURNAL" for Oct. 17, 1905 (p. 170), on the occasion of the visit of the North of England Association of Gas Managers.

Lifting Pressure under Dams.—The facts relating to the upward pressure of water under lofty embankments and the views of various engineers on this question are examined in the June issue of the "Zeitschrift für Architektur und Ingenieurwesen." According to an abstract in the Engineering Supplement to "The Times," the importance of an impervious coating on the inner face of the dam carried down to the rock foundation is insisted upon in the article; and it is pointed out that in strata in which minute hair-cracks and fissures occur, it is advisable to insert vertical vent-pipes communicating with the outlet tunnel, so as to provide free escape for any water weeping through the bottom of the reservoir, and tending, in consequence of the hydraulic pressure, to rise at the base of the dam. Diagrams are appended which explain the author's theories. It was observed in the case of the Solingen reservoir that this system of assisting the escape of water percolating through the rock by capillary action was very beneficial.

EXAMINATIONS IN "GAS SUPPLY."

[COMMUNICATED.]

(Second Article.)

BEFORE proceeding with the second article, dealing with the questions in the "Honours Grade," the author may remark that it will probably be urged that no candidate could possibly present such sketches as accompany answers within the time of 30 minutes allowed for sketching mentioned in the introductory remarks to the first article (p. 30). It must be borne in mind, however, that 14 questions in each grade have been dealt with; and when four-sevenths of the sketching is eliminated in each grade, it will be seen that a candidate accustomed to the use of the pencil could produce intelligible prototypes of the remainder within half-an-hour. An approximate analysis of the number of words shows that if the candidate in the "Ordinary Grade" attempted the eight permissible questions that have the longest answers, he would have to write at the rate of 20 words per minute; while if he attempted the eight permissible questions with the shortest answers, his speed would have to be 13 words a minute. Similarly in the "Honours Grade" the speeds would have to be 17 and 12 words per minute respectively. Sixteen of the 28 answers contain less than 300 words. The point referred to at the outset, therefore—that a candidate should aim at being able to write at a speed of not less than 15 words per minute—may be emphasized. Competence to do this, and the ability to produce the information sought by the examiner, should ensure the production of a really creditable series of answers. On the other hand, conciseness must be aimed at, and lengthy answers should only be given when the actual limits of the question make a necessity of them.

HONOURS GRADE.

1. What are the principles which govern (*a*) the construction of the mixing-tube of an inverted incandescent burner, including the size of its orifice, and (*b*) the shape of the inverted mantle? Explain the difference in the form of an inverted mixing-tube and mantle when compared with the mixing-tube and mantle of an upturned burner. (*36 marks.*)

(*a*) The mixing-tube must be so constructed as to ensure proper mixing of the gas and primary air, with consequent high flame temperature, injury from which must be avoided. The area must gradually increase towards the outlet; otherwise increase in volume of the heated gaseous mixture will produce friction, which tends to cause a smoky flame, firing-back, and decreased illumination. Gauze is not used to prevent firing-back, as this produces an unsteady flame. The material used in the construction of the tube should be non-conducting; thus abstracting as little heat as possible from the flame. Excessive heating of mixing-tube increases the ascensional force of the descending mixture of primary air and gas, endangering a shortage of primary air and shortening the life of the tube itself. Deflecting cones will protect the tube; but the burner efficiency is thereby slightly reduced. The gas-nipple should be kept cool. The size of orifice is determined by the fact that, if too small, the gaseous mixture issues with such force as to produce uneven illumination on the mantle, which is greatest at the lowest point. This shortens the life of the mantle. The orifice should be sufficiently large to produce evenness of heating over the whole surface of mantle. The specific gravity of the gas is the chief factor in determining the shape of mantle; the form of bunsen flames being modified by the tendency of the mixture of gas and air to rise. Thus the bunsen flame in its best condition is elongated in upright, and dumpy in inverted, burners.

(*b*) The annular space between the mantle-ring and the burner-head is necessary in order to facilitate the escape of combustion products, which, if compelled to pass through the mantle, would produce deposition of soot, and reduce the illuminating power. Magnesia is used in the construction of the ring because metal rings are quickly destroyed by the alternate lighting and extinguishing of the flame. The orifice of an inverted burner must be smaller than in an upright one, or a proportion of the gas will escape combustion by slipping upwards round the sides of the burner-tube immediately it issues therefrom.

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2. Describe two methods of governing the mixture of gas and air to the cylinder of a gas-engine. Which do you consider the most satisfactory, and why? (*36.*)

There are two general methods of governing the mixture of gas and air to the cylinder of a gas-engine—viz., (1) hit and miss, or regulating the speed of the engine by varying the number of impulses given to the piston; (2) variable impulse—*i.e.*, varying the strength of the impulse to the piston. Under each of these two systems there are three modifications—viz.:

Hit-and-miss.—(1) Holding gas-valve closed during one or more revolutions of the engine when running below full power. At the idle strokes, the engine is compressing and expanding a charge of pure air. (2) Holding the exhaust valve either open or closed during idle strokes. (3) Where electric ignition is used, cutting off current to igniter.

Variable impulse.—(1) Partially stopping gas supply. (2) Throttling the charge, and thus reducing quantity entering cylinder—proportions of fuel and air remaining the same. (3) Varying point of ignition.

Of the two general methods of governing, hit-and-miss regulation is the better, since it ensures greatest economy of fuel consumption and can be easily adjusted.

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3. What are the relative merits of lighting street lamps by (*a*) torches, (*b*) gas bye-passes, (*c*) flash lights, (*d*) automatic apparatus? (*36.*)

Torches.

Advantages.—Simplicity. Inspection twice daily with prompt renewal of mantles where required. Ensures all lamps being lit.

Disadvantages.—High maintenance costs through mantles and glassware being broken by direct contract and vibration, and subjection to high winds when opening door (unless specially devised torch inlet is provided). Labour costs highest. Extinguishing of torches.

Note: Torches which give a flash-light of benzolene vapour at an angle with the rod minimize the risk of breakage.

Gas Bye-Passes.

Advantages.—Breakages from contact, vibration, and winds avoided by non-necessity of opening lantern door. This is done by means of specially devised cock which lights gas and extinguishes bye-pass for lighting hours; the operation being reversed for non-lighting hours. Less time lighting than ordinary torches. Simplicity and inspection, same as torches.

Disadvantages.—Extra gas consumption in keeping bye-passes alight throughout 24 hours. High labour costs. Liability to be blown out.

Flash-Lights.

Advantages.—No torch to cause breakage. No door opening. No gas to keep bye-passes going. Simplicity and inspection, practically same as torches.

Disadvantages.—High labour costs.

Automatic Lighting (Clockwork).

Advantages.—Considerably less labour costs.

Disadvantages.—Costs of gas for bye-passes. Appliances occasionally faulty, owing to effect of weather, &c., but each mishap only affects one lamp. Delays in renewing broken mantles or glassware. Cost of installation.

Automatic Lighting (Pressure).

Advantages.—Minimum labour costs. No clockwork maintenance charges; but this is balanced by upkeep of special regulator to each lamp. Lights can be "switched" up instantly, even outside normal lighting hours, if arrangements are made with lighting authorities.

Disadvantages.—Cost of installation. Mishap may affect several lamps at once. Delay in renewals. Costs of gas in bye-passes, and liability of same to be extinguished.

General.

No one of these various methods of lighting can be described without qualification as perfect; but undoubtedly the lighting of lamps by automatic arrangements most nearly approaches the ideal, particularly if coupled with an efficient system of inspection, whereby faults in mantles, &c., are promptly remedied. Although not yet perfect, there is no doubt the future will see a rapid development of public lighting on these lines.

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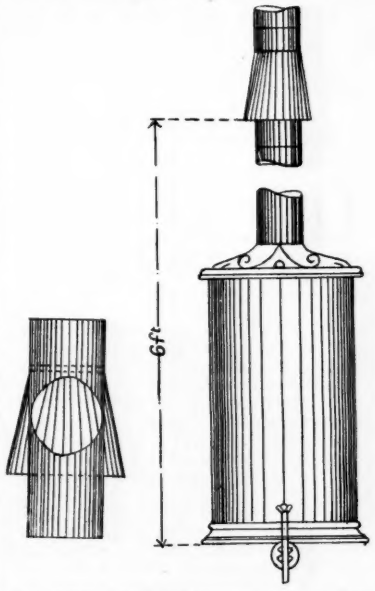
4. Upon what constructional points does the economy of a circulating water-heater depend? Should the outlet be connected to a flue, and if so, what provision is necessary to avoid waste of heat by excessive draught? How many gallons of water should a circulating heater raise 30° Fahr., consuming gas of 600 British thermal units gross, at the rate of 30 cubic feet per hour? (*36.*)

The gas and air must be so regulated that complete combustion takes place. The circulator must be so designed as to present the largest possible amount of surface for the conduction of the heat of combustion to the water. The metal must be a good conductor. No more heat must pass away unabsorbed than is necessary to constantly carry away the inert gases; thus preventing them from interfering with proper combustion and contaminating the atmosphere. It is upon this point that many water-heaters are faulty, the efficiency being reduced by excessive flue temperature. The outlet should be connected to a flue; but it is imperative that means be taken to prevent over-ventilation. To this end a canopy should be inserted in the line of the flue about 6 feet above the burners, as shown in sketch.



An additional regulator may also be provided in the shape of a damper beyond the canopy. It may be necessary also to have a cowl or Brassington valve at the outlet in addition. One B.Th.U. is the heat required to raise 1 lb. of water 1° Fahr. Therefore, 1 cubic foot of gas of 600 B.Th.U. would raise 600 lbs., or 60 gallons, 1° Fahr. As the water is to be raised 30°, and as there are 30 cubic feet of gas to do it, the theoretical result will still be the same—viz., 60 gallons. But a circulator does not give full efficiency; the best known result being about 90 per cent. Therefore the quantity of water raised 30° Fahr. by 30 cubic feet of gas of 600 B.Th.U. in a circulating heater will be 54 gallons.

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5. What precautions are necessary when fixing and adjusting gas-switch installations to ensure satisfactory results? Describe generally how you would carry out an installation in a church, and what provision you would make for extinguished bye-passes. (*36.*)

Up to the present, the only system of switch lighting that has had sufficiently lengthy trial to be considered satisfactory is the pneumatic—others being more or less in the experimental

stage. In carrying out an installation of this kind, the following points must be carefully observed: (1) The copper tube must be quite clear and sound, and the connectors free from dust, grit, &c.; all the joints being tight. (2) The plunger must be well greased, and work freely and effectively. (3) The valve must be quite clean, and contain no oil or grease, and be perfectly true in alignment. (4) The bye-passes must be reduced to the lowest point consistent with efficiency, and this should be determined at the time of minimum pressure. It is best to have the supply, however, governed. (5) Switches should be easy of access to verger or caretaker. (6) Installation should be carefully tested on completion.

In the carrying out of church lighting, much depends upon the character of the decorations and architecture, which would determine to a great extent the form of lighting adopted. The glass-ware in particular should be in harmony with the general scheme. Pneumatic tubes should be fixed so as to be unobtrusive, and away from possible damage. In a church of moderate dimensions the area lighting is best effected by two rows of pendants so placed as to give efficient and uniform lighting; the latter being determined by consideration of the form and intensity of light, and the distance from the floor level. Under no circumstances must lights be allowed to come in the line of vision between pew and pulpit. If there is a gallery, brackets, preferably with twin lights, should be placed at suitable points, with globes to obscure view of mantle at a minimum loss of light. It will be best to operate each bracket and pendant by a separate switch. In the case of faulty bye-passes, the lighting may be done in the usual way, with a rod and taper; but where the form of mantle permits, it is best to use those tipped with spongy platinum, the pressure of gas ensuring ignition, even if bye-pass fails. Although diminished lighting is not to be commended—*i.e.*, during sermon, &c.—if this is required, it may be obtained by having two switches to each pendant with half the lights on each. The verger should be instructed to try the switches half-an-hour before the lighting is required.

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6. Assuming the following heating appliances have been fixed at a consumers' premises, (*a*) a gas-steam radiator in workroom, (*b*) a register (basket) gas-fire in dining-room, and (*c*) a canopy gas-fire (with flue outlet) in bedroom, what respectively are the points upon which the consumer should be informed in order to secure hygienic efficiency at a minimum cost? (*39.*)

(*a*) To see that the room is well ventilated by having an efficient outlet at the ceiling. Have one or more vessels of water at unobtrusive points in the room, so that evaporation may compensate for the drying effect of the stove—*i.e.*, maintain the humidity of the room. Observe the water level at frequent intervals, and, when necessary, adjust it. Keep burners and stove clean. Keep gas low for a few minutes after lighting (so that no carbon monoxide may be formed).

(*b*) To turn on gas full pressure at first and adjust afterwards by patent adjuster (if any), or by tap if not. Observe method of lighting fire to avoid lighting-back. See that no ends or ashes of cigars or cigarettes, or other refuse are thrown on fire (or carbon monoxide will be formed). See that fuel be not disarranged. Notify gas undertaking if fire becomes faulty. Consumer should not tamper with it. (The ideal bunsen flame should be explained.)

(*c*) The same points as under (*b*) apply here, with the additional that the fire-place round the flue of stove should not be blocked up, and the consumer warned to keep this space clear, to ensure efficient ventilation.

If lit throughout the night, as in the case of invalids, a thermometer should be used to indicate temperature; the fire being regulated to the degree required. In all cases the importance of economizing by a due regard to temperature should be explained.

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7 (A).—In what way does compression of gas affect the heat from, and the temperature of, a bunsen flame? How is the calorific value of gas ascertained? (*39.*)

Compression has no effect on the total quantity of heat from gas, for the heat is the same (no matter what the conditions of burning) so long as combustion is complete. Compression, however, concentrates the flame, increasing its temperature, and producing a greater thermal efficiency. A better mixture of gas and air is also ensured by the greater velocity through the injector. The flame temperature is varied by the following considerations: (1) The time it takes for the combustion of a certain volume of gas; (2) the space in which the combustion takes place; (3) the amount of air taken to complete combustion.

The calorific value of gas is ascertained by passing the products of combustion from a bunsen burner through a piece of apparatus known as a calorimeter. Referring more particularly to the Junkers calorimeter, water is caused to pass over the surface heated by the products of combustion (as in a circulating water-heater). The gas is burned in a bunsen, placed in the centre of a cylindrical vertical cavity, at a rate of 5 cubic feet per hour or thereabouts. It is usual to pass 2 litres of water through the apparatus per test. At the top of the calorimeter, where the water is discharged, provision is made for inserting a thermometer, by means of which the temperature of the heated water is ascertained. Similar provision is made at the bottom with respect to the inflowing water. In making a test, the thermometers are inserted, the water supply turned on, the bunsen connected to a test meter, and lighted. When the temperature of the heated water is constant, the meter index is noted, and, simultaneously, the operator commences to collect the water. While the 2 litres are running through, frequent observations must be made of the temperature of the hot and cold water (say, six readings each), and the average of each taken for the calculation. The instant the required quantity of water has run through, the gas supply is turned off and the amount consumed during the test is noted. A small tube is provided at the bottom of the jacket in order to collect the condensed products due to latent heat. For every cubic centimetre of water collected at this point, 0·6 calorie per cubic foot of gas burnt is deducted. The calculation is made as follows:—

$$C = \frac{L\,(T - t)}{G} \times 3{\cdot}968 = \text{B.Th.U. gross}$$

$$C = \frac{L\,(T - t)}{G} - \frac{{\cdot}6 \times S}{G} \times 3{\cdot}968$$

$$= \text{B.Th.U. net.}$$

Where C = Calorific value of gas.
L = Litres of water passed.
T = Average temperature of heated water.
t = Average temperature of cold water.
G = Cubic feet of gas burnt.
S = Cubic centimetres of condensed water.
·6 = Constant.
3·968 = Constant, for converting calories to B.Th.U.

Example:—

L = 2 litres, T = 18° C. t = 4° C., G = ·19 cubic foot, S = 5 c.c's.

$$C = \frac{2 \times 14}{{\cdot}19} \times 3{\cdot}968 = 584{\cdot}129 \text{ B.Th.U. gross.}$$

$$C = 584{\cdot}129 - \left(\frac{{\cdot}6 \times 5}{{\cdot}19} \times 3{\cdot}968\right) = 62{\cdot}655.$$

$$C = 521{\cdot}474 \text{ B.Th.U. net.}$$

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7 (B). Discuss the relative merits of compressing (*a*) gas, (*b*) gas and air, (*c*) air only, in high-pressure installations. (*39.*)

(*a*) When coal-gas is compressed, some of its illuminating hydrocarbons are condensed out, the depreciation in illuminating value reaching as high as 16 per cent., with a pressure of 200 lbs. per square inch. With compression, however, as generally understood in lighting installations, no appreciable reduction in candle power results, for hydrocarbons at first condensed out are subsequently picked up again by the gas. Compression of gas ensures a more complete mixture of gas and air, a constriction in the size of the flame, a higher flame temperature, and therefore a greater thermal efficiency.

(*b*) When gas is mixed with air and compressed, the mixture, being heavier than coal gas alone, requires a larger nipple outlet to deliver the same quantity of gas. As it is desirable that the hole of the nipple should be perfectly concentric with the bunsen tube, the larger hole required for the mixed gas and air is more likely to ensure this. The mixture, too, having a relatively larger exit, is not reduced so much in pressure as when only gas or air is compressed, and less air is required for complete combustion. The intimate mixing does not rely so much on the construction of the bunsen-tube or the shape and size of the air-holes as in ordinary burners.

(*c*) When air is compressed, a suction is exerted on the gas which is delivered at ordinary pressure, thus reversing the process of ordinary burners in this respect. One great advantage of compressing air is that the high-pressure pipes contain air only, and any leakage occurring is perfectly innocuous. The efficiency claimed for this system is from 32 to 36 candles per cubic foot.

General.—The relative merits of the three systems must obviously be decided chiefly on the point of relative installation cost taken in conjunction with relative lighting efficiency. With proper workmanship, all three systems are perfectly reliable; and any claim that one is safer than another can hardly be seriously entertained. By compression of gas, 70 candles per cubic foot has recently been obtained; and it must be considered that for the present, at all events, this is one of the three systems most likely to find favour.

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8 (A). Describe fully the process of laying three 12-ft. lengths of 8-in. gas main, joints being made before dropping the main into the trench. What tools are necessary for the work? (*39.*)

The necessary tools should be on the spot before commencing operations—viz., shovels, picks, spades, spirit-level, hammers, yarning irons, caulking tools, pipe-joint clips, fire-grate, leadpan, ladles, shearlegs, pulley blocks, planks, sighting-board, and line. A trench is excavated to the required depth (not less than 2 feet of cover), and the bottom, unless naturally suitable, is prepared by concrete or wood battens as required; care being taken to ensure a slight fall of the main. The three lengths of main are placed on six V-shaped wood blocks along the side of the trench, spigots and sockets carefully cleaned, and spigots driven home into sockets. Pipes are then adjusted to a uniform level with sighting-board and line, yarn driven into sockets to uniform half-depth of socket, and a clay band or, preferably, a clip placed round face of socket with lip for pouring. Into the jointing space a little tallow should be placed to avoid "spurting." The lead is then run at one pouring, allowed to cool, the band or clip removed, excess lead chipped off, and the joint carefully caulked, the face of the lead being left smooth. By means of planks, the jointed lengths are placed in position over trench and lowered by pulley blocks from shear legs. The spigot end is then driven home into the open socket in trench; this joint then being similarly made. Pipes should be covered with clay or innocuous soil, and well "punned" in.

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8 (B). What tests would you apply to demonstrate the relative efficiency of various forms of lead joints in gas-mains, bearing in mind common causes of leakage at such joints? (*39.*)

Typical forms of the joints to be tested should be prepared by taking two or three lengths of cast-iron or steel mains, and in each case carefully plugging up both ends with the same form of joint. By means of hydraulic pressure supplied from an accumulator, a test may then be made, the pressure being increased until one or other of the joints gives, and notes taken of the duration of test, and nature of fracture or leakage. This will determine the merits of joints for resisting leakage from high-pressure distribution, but would be of little value for ordinary distribution, where leakage is caused chiefly by surface pressure, subsidence, or vibration. A deflection test should be applied. Pipes of equal length and diameter should be used to prepare typical joints. Then these are, in turn, suspended at each end on supports, and weights suspended from the centre; the weight being gradually increased and the amount of deflection carefully noted. If the specimens are also closed at each end by joints similar to the one under test, filled with air to a known compression, and an indicator attached, the point at which leakage begins may also be ascertained.

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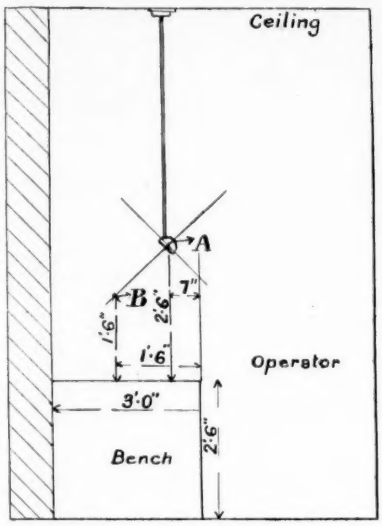
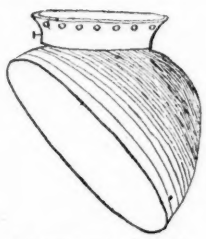
9 (A). In a workshop the greatest light intensity is required at a point 18 inches from the front of the bench, and an equal distance above it. Show by sketches in what position you would fix a low pressure inverted burner of the "Nico" type so as to obtain the greatest efficiency, and state the type of reflector you consider best for the purpose. (*39.*)

The best position in this case is 2 ft. 6 in. vertically above the bench, and about 7 inches

from the front edge of the bench inwards. It will also be noted from sketch that a line joining the centre of the mantle with the point to be illuminated will be at right angles to the reflector. The sketch also shows the type of reflector used, which is an angle Pagoda prism glass reflector. It is also advisable to have metallic tube for the pendant, in case the workman requires to move the point of concentration of the rays.





Enlargement of Shade.

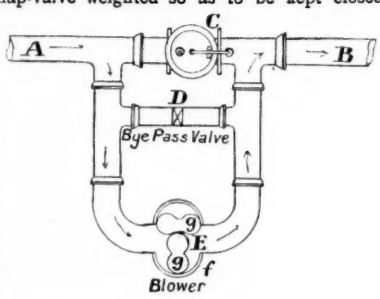
9 (B). What proportion of the light rays from an upturned burner are radiated above the horizontal, and how is this ascertained? What means are adopted in street lighting for ensuring the greatest lighting efficiency on the road surface? (*39.*)

There does not appear to have been any research in this country into the proportion of light rays radiated above the horizontal, though a considerable amount of investigation has taken place into the light rays thrown below, as in street lighting, &c. Investigations abroad by Professor Drehschmidt found the proportion above the horizontal as 1·2 is to 1. Professor Wedding found the proportion 1·7 to 1. The difference is ascribed to the varied form of mantle used. The results were obtained by the use of a mirror set at an angle of 45 degrees upon a revolvable axle, and attached to a specially designed parallellogram, upon which was fixed an arrangement for supporting the burner. The burner retained its vertical position while the parallellogram was rotated; and in this way the light radiated at varying angles was obtained The apparatus was set up so that the light which fell on the mirror at varying angles was reflected in the direction of the axis of a photometer bar, by which its intensity was measured in the same manner as burners are ordinarily tested. The results quoted above show the importance of deflecting lights rays in a downward direction; and this is effected by means of suitable reflectors. With reflectors at least 20 per cent. of the maximum light developed is lost, however, in addition to the loss caused by obstruction of lanterns, pillars, or burner fittings. For this reason (in addition to the fact that a greater proportion of rays are thrown in a downward direction), the inverted burner is likely to displace the upright for street illumination.

10 (A). By what methods may the pressure thrown by the gasholders be raised for the purpose of reinforcing the supply to the district mains or the distributing governors? Describe one of such methods as applied in practice. (*39.*)

The pressure thrown by the holders may be raised by means of any one of the four following appliances: (1) Roots blower. (2) Fan. (3) A Reciprocating compressor. (4) Rotary exhauster. Roots blowers are now largely used for capacities up to 25,000 cubic feet per minute, working at pressures up to 3 lbs. per square inch. For higher pressures, the blowers are worked in series.

The accompanying sketch shows the Root's blower form of pressure-raising plant. The gas comes from holder at A; and B is the main which supplies the district. D is a bye-pass flap-valve weighted so as to be kept closed unless the pressure in B exceeds the required amount, in which case D opens and permits gas to pass back to the inlet. C is an automatic governor which actuates the flap-valve on the main leading direct from gasholder to district. This valve is closed so long as the apparatus is in working order, but opens if any mishap occurs and permits gas to be supplied straight from holder to district. E is a Root's blower, which consists of an outer case *f*, shaped as shown in sketch. The semi-circular parts of the case are securely bolted to the main body. The revolvers *g* rotate, and are made of cast iron. The cycloidal faces of the revolvers are machined true to gauge, so as to accurately fit each other, and also the case. The revolvers rotate in an opposite direction to each other. Suitably geared wheels are attached to the blower and are driven from a pulley.



10 (B). A 6-inch gas-main is increased in length from 1200 yards to 3600 yards. What increase in the initial pressure of 1 inch is necessary to secure the same discharge of gas, and upon what formula is the answer based? (*39.*)

The answer to this question is based on the formula devised by Dr. Pole:—

$$Q = 1350d^2\sqrt{\frac{hd}{sl}}$$

where Q = quantity of gas discharged in cubic feet per hour.
d = diameter of pipe in inches
h = pressure of gas in inches head of water
s = specific gravity of gas when air = 1
l = length of main in yards.

In this case, let the first length be l = (1200 yards)
and ,, increased ,, ,, l_1 = (3600 yards)
Let the first pressure be h = (1 inch)
,, ,, required ,, ,, h_1
It is required to find h_1

Now Q is the same in each case, also d and s.
Hence

$$\frac{Q}{Q} = \frac{1350d^2\sqrt{\frac{hd}{sl}}}{1350d^2\sqrt{\frac{h_1d}{sl_1}}} = \frac{\sqrt{\frac{h}{l}}}{\sqrt{\frac{h_1}{l_1}}}$$

But Q is the same in both.

Hence $$\sqrt{\frac{h}{l}} = \sqrt{\frac{h_1}{l_1}}$$

i.e., $$\sqrt{\frac{1}{1200}} = \sqrt{\frac{h_1}{3600}}$$

$$\therefore \quad \frac{1}{1200} = \frac{h_1}{3600}$$

$$\therefore \quad 1200h_1 = 3600$$

$$\therefore \quad h_1 = 3$$

That is, the new pressure must be 3 inches. Hence the pressure must be increased by 5 inches.

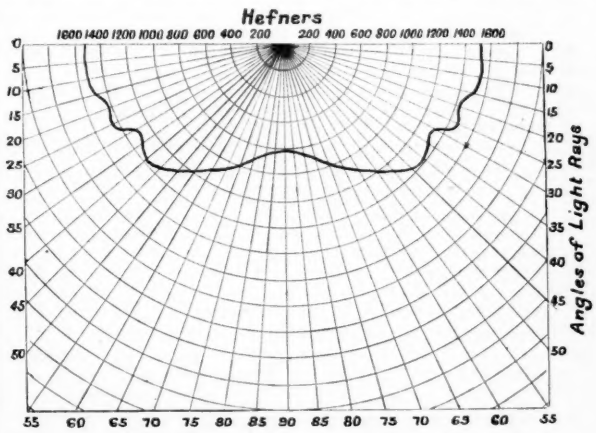
THE KEITH HIGH-PRESSURE INVERTED LAMP.

Tests by Dr. Wedding.

Some tests have lately been made in Technical Institutes of Germany of the new Keith high-pressure inverted gas-lamp. Among others, Dr. Wedding, of Charlottenburg, has tested two samples of the lamp—a large one designed for outside lighting, and a small one suitable for inside and outside lighting. The following report has been submitted by him.

The lamps were supplied with gas, raised to a high pressure by a compressor driven as a gas-pump by means of a direct-coupled electric motor. The compressor worked with the weak load of only one of the two lamps quietly and evenly during the test. Concerning the merits of the compressor, no further opinion can be expressed, as, for such an opinion, a test would have to be made with full load, and be extended over a prolonged period to ascertain the wear and the merits of the various constructional parts. This was impossible under the circumstances. An opinion can, however, be formed with regard to the merits of the lamp or burner construction, by measuring the light.

The large lamp, with inner and outer globe and reflector, was submitted to two tests at various pressures. The first test took place with a surplus pressure of 112 mm. mercury column, and the second with a surplus pressure of 162 mm. mercury column. The measurements were taken simultaneously by two men on opposite sides of the lamp, under angles varying from the horizontal to the vertical immediately underneath the lamp; while during the whole of this time the gas pressure, the gas consumption, and the heating value of the gas were taken. From the light measurements, taken on both sides of the lamp, the mean values under equal angles were chosen and entered as a curve on Diagram I. From the integration and planimetry of this curve, it will be seen that the mean hemispheric lighting effect for the

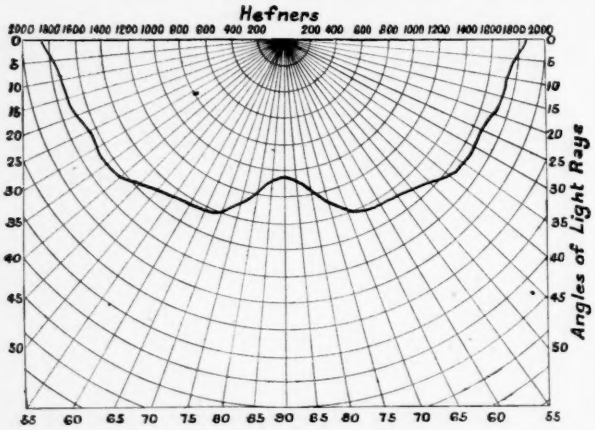


No. 1—Test of 1500-Candle Power Lamp on May 16, 1908.

lower hemisphere is 1360 H.K. [hefners], with a surplus pressure of 112 mm. mercury, and a gas consumption of 761 litres per hour reduced to 0° C., and 760 mm. barometer level. From this,

it follows that the specific consumption was 0·56 litre per H.K. Owing to the fact that the practice still frequently prevails of taking light measurements in a horizontal direction, it might be mentioned that, horizontally measured, the lighting effect was 1520 H.K., which showed a specific consumption of 0·5 litre per H.K. The heating value of the gas was 4705 calories per cubic metre. From this, it results that the lamp showed a specific calorific consumption of 2·63 calories per H.K., when measured hemispherically, and 2·36 calories horizontally.

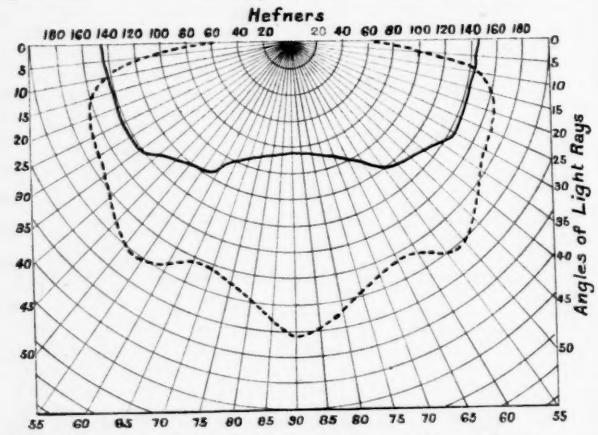
The second test was made by supplying the lamp with gas under a considerably higher pressure by loading the valve of the compressor. The pressure of 162 mm. mercury remained throughout constant. No variation was noticeable on the manometer, which, in view of the weak load of only one lamp, shows that the compressor works very evenly. The mean curve for the light distribution during this test is illustrated on Diagram II. The mean



No. 2—Test of 1500-Candle Power Lamp on May 19, 1908.

lighting effect for the lower hemisphere was found to be 1636 H.K.; while the gas consumption per hour was 895 litres reduced to 0° C., and a barometer level of 760 mm. This shows a specific consumption of 0·548 litre per H.K. hemispherically measured. The heating value of the gas was 5057 calories per cubic metre, so that the calorific consumption was 2·77 calories per H.K. hemispherically measured. Horizontally measured, the lamp gave a maximum light of 1860 H.K., which represents a specific consumption of 0·482 litre per H.K., and a specific calorific consumption of 2·43 calories per H.K.

When comparing the results of the two tests, it will be found that no essential difference exists in the values obtained from the gas under the two different pressures of 112 and 162 mm.



No. 3—Test of 1500-Candle Power Lamp on May 16, 1908.

[The black line shows the results without the reflector; the dotted line, those with it.]

The second lamp for small lighting effects represents a small compact model of a lamp, very pleasing in its outer form, for lighting show windows, work-rooms in factories, &c. The principle of the lamp and its inner construction are the same as that of the larger one. The smaller lamp was tested without and with a reflector of white enamelled sheet iron, under the same pressure and the same heating value of the gas as the large lamp during the first test. As the hourly consumption of gas during the test without a reflector was 87 litres, and during the test with a reflector 88·2 litres, it is possible to compare the mean curves for the two tests on the assumption that the consumption was practically the same. For this reason both the curves have been entered together in Diagram III. For the small lamp without reflector, the black line on the diagram shows the mean hemispherical lighting effect of 128·7 H.K. for the lower hemispherical measurements while the gas consumption was 87 litres per hour, the pressure 112 mm. mercury, and the heating value of the gas 4705 calories per cubic metre. This represents a specific consumption of gas equal to 0·677 litre per H.K. hemispherically measured, and a specific calorific consumption for the hemispheric measurement of 3·18 calories per H.K. Horizontally measured, the lamp gave 145 H.K., equal to a specific consumption of 0·6 litre per H.K. and a calorific consumption of 2·82 calories per H.K.

The same lamp with reflector gave a mean hemispherical lighting effect of 169·9 H.K. with a consumption of 88·2 litres, equal to a specific consumption hemispherically measured of 0·519 litre per H.K. and a mean specific calorific consumption for the hemispheric measure of 2·44 calories.

No purpose would have been served to have measured the effect horizontally, as the reflector reaches down so far that much light was cut off in this direction, as is shown by the dotted line on Diagram III. The reflector has the result of strongly collecting the lighting effect downward.

The following table contains a summary of the values obtained.

Description.	Pressure in Mercury.	Consumption of Gas per Hour.	Calorific Consumption per Hour.	Mean Lighting Effect Hemispherically.	Specific Consumption of Gas	Specific Consumption of Gas.
	Mm.	Litres.	Calories.	H.K.	Litre.	Calories.
Large lamp . . .	112	761·0	3580	1360·0	0·560	2·63
,, ,, . . .	162	895·0	4520	1636·0	0·548	2·77
Small lamp, without reflector . . .	112	87·0	409	128·7	0·677	3·18
Do., with reflector .	112	88·2	415	169 9	0·519	2·44

From a comparison of the figures in the attached table one with the others and with other figures which have become known from tests made with lamps of similar lighting effects, it is evident that the smaller lamp with reflector is more effective than the larger lamp, as regards the specific consumption, both in gas and in calories. It follows, further, that from the increase of pressure from 112 mm. to 162 mm.—*i.e.*, about 50 per cent.—a materially improved effect is not secured.

The value obtained from the gas and its heating effect is very favourable in the Keith lamp, and better than in many other lamps. The pre-heating of the gas in the flat chamber arranged near the burner-tube has evidently a strong bearing on this favourable result. If, during prolonged use, the chamber, which is strongly exposed to the hot burning gases, should prove good, then the Keith lamp represents a further progress in lighting by pressure gas both for higher and also for lower light units.

STUDIES IN THE CARBONIZATION OF COAL.

[Extract from the Forty-Fourth Annual Report of the Chief Inspector under the Alkali Act.]

In the forty-third annual report (for 1906), some attention was devoted to recent valuable contributions to the knowledge of the effect of temperature on the carbonization of coal under different conditions and for different objects. Both the gas engineer and the coke-oven manager have need of all the temperature data available for the exact control of their respective industries; the operations, moreover, having very different ends in view, and requiring for their successful conduct plant of very different kinds.

More than eleven years have elapsed since Mr. Charles Hunt, at the meeting of the Institution of Gas Engineers, in May, 1896, gave an account of results obtained in his examination of the working of the Semet-Solvay coke-ovens at the Brymbo Steel-Works—an examination, from the gas engineer's point of view, of carbonizing coal in bulk as compared with carbonizing it in the small charges of the gas-retort.* Since that date, much experience has been gained in this industry; and in the annual report for 1900 I gave some account of the somewhat ambitious scheme adopted at Boston (Mass.), in which the richer portions of the gases from coke-ovens were reserved for supplying illuminating gas, and the poorer portions for heating the ovens. After various vicissitudes, the process appears to have met with such success as to be receiving extensions on a considerable scale in other districts in the United States where conditions are favourable for its introduction.

The above-mentioned vicissitudes were due in large measure to the difficulties and complications introduced by endeavouring to combine what are now seen to be practically incompatibles—viz., a good quality of metallurgical coke with an important yield of illuminating gas. Only when the former aim was abandoned for that of producing a coke superior to gas coke, and fit for general and industrial use, did financial success attend the promoters' efforts. It is, however, doubtful if such conditions exist largely in this country. Local authorities would look askance at the establishment of such works as a coke-oven works in a highly populous and congested district. While to discharge and quench

* See "JOURNAL," Vol. LXVII., p. 1090.

incandescent gas coke in small quantities at a time—not exceeding 4 to 5 cwt.—may be endured with fair equanimity, the volumes of steam and amount of dust arising from the discharge and quenching of 4 to 5 tons of coke from ovens, together with the fumes from the charging of 6 to 8 tons of coal for the fresh charge, would create such an amount of nuisance to householders as to justify the greatest hesitation of a sanitary authority in permitting the establishment of such an industry under such conditions.

During the past decade, the economies effected in oven working, especially in the direction of utilizing the high temperature of the products of combustion passing from the oven flues for raising the temperature of the incoming air needful for combustion by means of regenerative appliances, have liberated a still greater proportion of gases for other uses than that of heating the ovens. Usually this surplus gas goes to raise steam for operations in the works. In some cases gas-engines are driven directly by the gas, of one notable instance of which a special account is given below. In one instance, a municipality owning its own gas-works was offered the surplus gas from several batteries of ovens (for subsequent enrichment and distribution); but no agreement could be made as to the terms of purchase. In another instance, a district electric supply company obtain power for their turbine-driven dynamos from the steam raised by surplus coke-oven gas.

During the same period, the attention of gas engineers has been directed to the results obtained by carbonizing coal for the production of illuminating gas in vertical retorts. While the system as applied on the Continent has been worked on intermittent charges—*i.e.*, the retort is filled with fresh coal, worked off, and the resulting coke is withdrawn in batches—one system that has operated on an experimental working scale in several works in this country aims at combining the advantages of the vertical retort with those of continuous feed of coal and withdrawal of coke. On either intermittent or continuous system, the application of the vertical retort has had a very marked effect on increasing the yield of ammonia, and on the constitution of the tars. Moreover, in the intermittent system, as represented by the Dessau retort, which has been longest in operation, experiments (in one instance extending over nine months) show that a reduction of about 40 per cent. of cyanogen may be looked for in the crude gas. Both at Dessau and at Berlin, a marked reduction in naphthalene is noted. In the Dessau retort, it appears clear that the gas, as formed, ascends the retort in the centre of the charge, which is only very partially the case in the modern coke-oven. In the former case, the gas is removed, as far as possible, from the action of the radiant heat of the walls of the retort and direct contact both with the latter and with incandescent carbon, and so is less subject to the secondary changes induced in the valuable illuminants when radiant heat has this opportunity of action, as in the upper portion of the ordinary horizontal gas-retort.

The engineering difficulties of designing and working continuous plant on the large scale have, fortunately for gas engineers, been already solved in an analogous industry—*i.e.*, the distillation of shale for the production of paraffin oils in Scotland—and solved in so complete and perfect a fashion as to suggest that, in this latter industry, at any rate, means have been so perfectly adapted to ends that no very great economies in retorting costs seem possible. This experience will be of great value to those now engaged in meeting and providing for the differences in conditions of continuous distillation of coal for the production of illuminating gas, where access of air to the retort on the withdrawal and removal of the coke has to be provided against with greater certainty than in the case of shale retorting. Not only, too, has the yield and quality of the gas to be watched by the gas engineer, but also the saleable value of the most important residual, coke.

In addition to the reduction of naphthalene, Herr Körting notes at the Berlin works reductions of 50 per cent. in the amount of sulphur compounds, consisting chiefly of thiophen and bisulphide of carbon. Though the statutory limits for these compounds have been abolished as regards the gas supply in the Metropolitan area, those who are responsible for the conduct of the very large Metropolitan gas undertakings have always recognized the duty incumbent upon them to use the best practicable means to remove these objectionable compounds from the gas supplied to their consumers. Their contention as regards the use of foul lime to compass this removal was that the action of the latter was extremely uncertain, and that it was not equitable for penalty to attach to infraction of statutory limits, sometimes beyond the control of their engineers, managers, and chemists, whatever efforts were used. It may therefore be expected, with confidence, that the vertical system of retorting will receive a patient examination and trial at their hands. The results, indeed, of a trial installation of the continuous retort at the works of one of the London Gas Companies were made public last November,* and were of decided encouragement to continue the erection of a plant on a larger scale. Extreme value attaches to the results published last January by Herr E. Körting,† since he is enabled to compare the results of carbonizing the same quality of coal in three different works under his charge in Berlin, using four different systems of retorting.

An interesting departure has for the last three years been made by Mr. G. R. Love, of the Guildford Gas Company, in the erection of a setting of eight retorts set at an angle of 45°. The retorts are of the same length and the same sectional area as the horizontal settings. Results, therefore, are strictly comparable—the coal supply being the same. Naphthalene has never been a trouble at Guildford; and no knowledge exists as yet as to cyanogen conditions in the gas from either source. It is known, however, that carbonic acid is present in unusual proportion in the gas from the 45° inclines; also that the tars are unusual in composition—the amount of pitch yielded being much less, the free carbon less to a remarkable extent, and the quantity of naphthalene separated on cooling the heavy oil portion of the distillate much smaller than in the case of the tars from the horizontal retorts. The coke is much harder and denser, and commands a correspondingly higher market price. As regards the ammonia yield, no separate estimation can be made; but the total ammonia yield of the works has gone up from 16·5 to 19·5 lbs. of sulphate per ton of coal carbonized—no change having been made in this period in the class of coal carbonized (Durham). In all respects, therefore, the results seem to approximate to "vertical" conditions. The charging and discharging are intermittent; but the carbonizing periods are longer—one 8-cwt. charge in twelve hours in the 45° inclines, compared with two 3-cwt. charges in the same period in the horizontals.

The success that may be said even now to have attended the application of intermittently charged vertical retorts for coal carbonizing in gas-works has stimulated some of those engaged in the coke-oven industry to adopt the same principle, and to construct—only experimentally, so far—vertical coke-ovens for operating on the large scale.

The contributions to technical literature on the subject of carbonizing coal that have recently been made, and especially in the past year, may be divided into two main groups: (1) Carbonizing coal in bulk in coke-ovens and in intermittent vertical and steeply inclined retorts (45°). (2) Carbonizing coal continuously in vertical retorts, only a comparatively small quantity of coal occupying the gas-making zone. Some of the results and conclusions of these contributions are of sufficient interest to find mention.

To the author of one paper (Institution of Gas Engineers, June, 1907*), I am already indebted for the heat diagram taken throughout a charge given in the report for 1906. Mr. Bury directs attention to the differences of constitution of gas as the coking proceeds, and especially towards the close of the operation. [See analyses at 17 hours and 22 hours respectively in the table next page.] The breaking-up of marsh gas (CH_4), and the increased opportunities of access of air to the retort, as shown by the increase of nitrogen, are notable. Comparison also may be made with the figures at 16 hours and 21 and 26 hours respectively in the paper by Mr. Short before the Society of Chemical Industry last year, where opportunity is also given to compare the average composition of gases from the Otto-Hilgenstock ovens with that of samples taken at different stages from an individual oven. I also give, for comparison, analyses of Brymbo Semet-Solvay coke-oven gas, (*a*) by Mr. J. H. Darby and (*b*) by Mr. Charles Hunt (from his paper to the Institution of Gas Engineers in 1896), for North Wales coal; also of oven gas from the coking of Yorkshire coal from a modern Simon-Carvès vertical flued coke-oven installation. This last was contributed by Mr. Rhodes in a paper read at the meeting of the Institution of Gas Engineers in June, 1907;† and, lastly, the analysis of an average sample of gas from the coke-ovens at Bargoed, South Wales, of which fine installation some particulars are given below.

The illuminants are described variously in the analyses as "Olefines," "C_nH_{2n}," "C_2H_4," "C_6H_6," "Unsaturated hydrocarbons," and "Ethylene." Mr. Rhodes disregards their presence. Nitrogen appears always to be estimated as a difference figure, and includes, therefore, all the errors of analysis. As pointed out by Mr. Lewis T. Wright in the discussion on Mr. Charles Hunt's paper, it is extremely desirable that the methods of estimation should be set out by the analyst, especially in this case, where air is used in the eudiometer for the estimation of the hydrocarbons and hydrogen.

Mr. Bury dwells at some length on the unsuitability of the conditions in the metallurgical coke-oven for producing the maximum of these illuminants, and for conserving them from future chemical change before leaving the oven, as compared with the conditions existing in horizontal gas-retorts, where charges of 6 to 8 cwt. of coal (as a maximum) only are carbonized, in place of 4 to 8 tons in the coke-oven. The increased height (to 8 feet)* of the latest design of coke-oven in vogue now with all the principal oven constructors enables heavier charges to be coked with but little increase in the time required for carbonization.

By studying the relationship between hydrogen and marsh gas in the oven gas derived from coking a particular class of coal, Mr. Bury is enabled to state the average heat of carbonization to which a charge is being subjected by the percentage of marsh gas that a sample of the gas contains. As the proportion of this constituent decreases with rise of temperature, so that of hydrogen increases. Mr. Bury states his conclusions as follows:—

> 1.—That in the coke-oven the coal is heated at a lower temperature than it is in the gas-retort, and that the yield is therefore primarily lower; that any further addition to the yield takes place at the expense of the illuminants; but that, even after this has occurred, the total yield is 10 per cent. lower than would be obtained from the gas-retort using the same coal.
>
> 2.—That in the gas-retort the heat penetrates rapidly to the centre of the charge, with the result that the gas is generated at a

* See "JOURNAL," Vol. C., p. 477. † *Ibid.*, Vol., CI., p. 93.

* See "JOURNAL," Vol. XCVIII., p. 982. † *Ibid.*, Vol. XCVIII., p. 981.

Sample.	Per 100 Volumes.							Remarks.
	CO_2	O_2	CO	H_2	CH_4	C_nH_{2n} &c.	N_2	
1895.—Semet-Solvay Ovens, Brymbo	3·27	0·23	7·95	52·77	31·22	2·57	1·99	Mr. Darby ("Jour. Soc. Chem. Ind.," 1895, p. 338.)
1896. ,, ,, ,, (1)	*3·80	..	10·10	52·20	29·60	4·30	..	Mr. Charles Hunt (Institution of Gas Engineers, May, 1896.)
,, ,, ,, (2)	*4·10	..	9·90	45·90	22·90	3·70	13·50	*Nos. 1 and 2, unpurified, include H_2S; this in No. 2 = 0·8.
,, ,, ,, (3)	..	..	9·80	57·10	29·40	3·70	..	No. 3, taken after benzol absorber; gas at time of sampling richer than usual in illuminants.
Gaslight and Coke Company, Birmingham (Windsor Street)	..	0·10	7·50	49·20	34·20	4·70	4·30	
	..	..	6·80	46·20	37·50	4·90	4·60	
1907.—Semet-Solvay Ovens, Brackley—								Mr. E. Bury (Institution of Gas Engineers, June, 1907.)
Lancashire coal, aver. over 17 hrs.	2·50	0·40	6·40	49·10	33·90	3·70	4·00	Calorific value, 540 B.Th.U.
Another carbonization of same coal, aver. over 22 hrs. .	2·00	1·40	7·00	51·80	24·80	2·10	10·90	,, ,, 480 B.Th.U.
1907.—Otto-Hilgenstock Ovens, Blaydon—								Mr. Short ("Jour. Soc. Chem. Ind.," 1907, p. 582.)
At 1 hour	1·40	0·80	5·40	39·20	41·10	5·60	5·50	
6 hours	2·20	0·80	4·90	44·80	36·10	5·00	6·20	
11 ,, ...	1·40	0·70	4·30	47·90	34·10	3·40	8·20	
16 ,, ...	1·00	0·20	4·40	54·50	29·80	1·40	8·70	
21 ,, ...	1·00	0·20	4·60	62·60	23·00	0·20	8·40	
26 ,, ...	1·40	0·40	9·20	59·20	4·60	0·00	25·80	
Average . . .	1·80	0·60	5·00	51·50	28·40	3·80	8·90	Calorific value, 500 B.Th.U. (net).
1907. — Simon-Carvès Company, Rotherham :—								Mr. Rhodes. (Institution of Gas Engineers, June, 1907.)
Washed slack	4·29	0·46	8·41	39·85	28·21	..	18·78	Coal—Volatile, 28·55; ash, 7·8; fixed carbon, 63·65. Calorific value, 450 B.Th.U. at start; 350 B.Th.U. at finish.
1907.—Kopper's, Bargoed	2·01	0·42	5·21	63·42	23·14	0·80	5·00	Mr. Hann. (Proc. South Wales Institute of Engineers, Vol. XXV., No. 6, p. 480.)
1907.—Woodall-Duckham vertical retort — Bournemouth, Yorkshire coal	1·80	..	8·20	54·80	23·80	3·60	7·8	Average working results, 22 days :— Cubic feet of gas per ton, 13,021. Illuminating power, 14·20 candles. Calorific value, 546 B.Th.U. No naphthalene; cyanogen, a mere trace. Tar per ton of coal, 16·7 galls. (sp. gr. 1·075). Gas liquor, do., 42·3 galls. (8 ozs.) (J.G.L., June 4, 1907, p. 641.)
Nine Elms, Burley Silkstone coal	2·22	0·27	7·41	45·85	35·05	2·88	6·32	Cubic feet of gas per ton, 12,633 (unpurified). Illuminating power, 15·82 candles. Calorific value, net, 526·3 B.Th.U.; gross, 593·8 B.Th.U. (J.G.L., Nov. 12, 1907, p. 477.)

higher temperature, leading to a bigger primary yield; furthermore that, owing to the minimum heating surface which is presented to the evolved gases, the illuminants escape from the retort before decomposition has time to take place; thereby maintaining a high yield with a greater heating and lighting efficiency.

The rate of carbonization is much more rapid in the horizontal gas-retort than in the coke-oven. Mr. Bury gives the comparative figures for the same class of coal carbonized per 1000 square feet per hour as: Gas-retort, 2·13 tons; coke-oven, 0·55 ton. The Brackley coke-oven results are here compared with those of gas-retort carbonizing at Southport in the paper by Mr. J. Bond read before the Institution of Gas Engineers in May, 1905.*

If these conclusions are at all justified as regards the comparison with the horizontal retort, they are still more so with respect to the vertical retort. In the latter case, the comparative absence of naphthalene indicates the carbonization as having been effected at low temperature, and yet with increase of absolute yield of gas; the factor of yield multiplied by illuminating power, and still more that of yield multiplied by calorific power, being quite adequate.

Already, in June, 1907, Herr Körting, treating of the working of the Dessau retorts at Berlin, showed that attempts to still further increase the yield of ammonia, by injection of steam into the retort towards the close of carbonizing the charge, were unsuccessful—no increase being shown. The conditions, however, are not those of a gas-producer where, if carefully worked by the attendant, no free passage for rapid escape of the added steam will exist; but the latter will have to distribute itself more or less equally through the incandescent mass. In the Dessau vertical retort, on the other hand, a central vertical channel is formed during the progress of carbonization, through which the gases evolved are enabled to escape quickly from the heated zone, with fewer opportunities for polymerizing and breaking up into compounds of lower illuminating value. Through this channel, it would appear that the steam subsequently added for increased ammonia production also finds its means of egress with minimum contact with the incandescent coke.

In the continuous vertical retort, on the other hand, the conditions may be said to approximate to those of the shale-retort, in which the yield of ammonia, by the application of steam to the lower section of the retort to burn the fixed carbon in the shale, has been increased to more than 42·7 lbs. of sulphate per ton of shale retorted. Up to 1882, the yield from 1869 onwards with the old vertical retort was about 12 lbs. of sulphate per ton of shale retorted. But it must be borne in mind—as pointed out by Mr. George Beilby in his paper read before the Scottish Section of the Society of Chemical Industry in 1897, that the shales in general use in the earlier years of the industry, while yielding more oil on the older methods of distillation, yield less ammonia than the poorer oil shale mined from greater depths which now forms the preponderating source of supply; so that the whole increase from 12 lbs. in 1882 to 42·7 lbs. in 1906 must not be attributed exclusively to the employment of steam in the lower portions of the modern shale-retort.

While the application of steam in gas manufacture must necessarily have strict limits if coke is not to be deteriorated, the application of a gas rich in hydrogen, such as "blue" water gas, might be found to have an advantageous effect on the yield of ammonia without a corresponding disadvantageous effect on the quality of the coke. It may be surmised that the chief reason why the process patented by Mr. R. Tervet in 1883, and described by him in a paper contributed to the Society of Chemical Industry,* found no acceptance on the large scale, lay in the impossibility of bringing the hydrogen into contact with the incandescent coke in the horizontal gas-retort—the gas choosing the way of least resistance.

The proposal of Professor Vivian B. Lewes, in 1900, to inject "blue" water gas along the crown of the horizontal retort during the period of carbonization when the bulk of the illuminating gas is evolved, and adjusted in proportion, roughly, to the rate of such evolution, had quite a different object from the above; the latter proposals seeking to conserve and increase the illuminating value of the mixture of gases leaving the retort. He recognized, however, as shown in his paper read before the Gas Section of the Engineering Congress at Glasgow in September, 1901,† that one function of the added water gas was to exercise a cooling influence on the crown of the retort, of the same character as was effected by the steam blown into the Mond producer, and lower the temperature of the mass of fuel to a point at which the ammonia escaped as formed without being broken up by contact with highly incandescent surfaces on its way. He anticipated, therefore, a substantial increase in ammoniacal liquor by the application of his process; but it is understood that practically this was not attained.

The extra yield of ammonia and the much reduced production

* See "JOURNAL," Vol. XC., p. 691.

* See "JOURNAL," Vol. XLIII., p. 20.

† See "JOURNAL," Vol. LXXVIII., p. 623.

of hydrocyanic acid, noted both by Dr. J. Bueb, of Dessau, and Dr. W. Bueb, of Berlin, in their experimental work on the Dessau retort, suggests a relationship in these phenomena, and that in the freer passage of the products of destructive distillation to less heated zones, and by their rapid removal from contact with incandescent carbon, the ammonia generated passes as such from the retort in greater measure than in the case of horizontal retorts. In the vertical continuous (Woodall-Duckham) retort—the only one of this type as yet in operation—it is claimed that, though the heating of the retort by producer gas takes place at the top, the heated products of combustion being drawn downwards by chimney suction, the inner part of the retort at this point, where the coal-feeder is continuously introducing fresh charges of coal, is nevertheless kept comparatively cool; that though so much heat is being applied outside, this heat is supplying the energy needed for the work of destructive distillation, and is being absorbed, and so does not appear as sensible heat till the charge has descended lower in the retort and is getting spent; that the coal, therefore, is subjected to a process of fractional decomposition—each fraction of gas and vapour coming off at its own critical temperature, and never having to pass through any temperature higher than that at which it is evolved. This would explain the difference in the quality of the tar; this not having been subjected to any decomposing action. The study of its constitution suggests to the patentees that in their own particular case its most useful function is as an enricher of the gas, and its physical properties—it resembling water-gas tar in consistency—offer no obstacle to its return to the retort. Should these views be confirmed by a wider experience, the ammoniacal liquors treated may be hoped eventually to contain a smaller proportion of cyanogen compounds, which, whether existing as volatile or fixed salts of ammonia, are the cause of anxiety to the manufacturer, as is well known to readers of recent annual reports. For the present, however, I have only obtained two average samples of liquor from the latest form of vertical continuous retort—a single one—working at the Poole works of the Bournemouth Gas and Water Company. The cyanogen contents here are exceptionally high, and further knowledge of the conditions of working is needful before elucidation of the causes of this unexpected result can be put forward.

In the opinion of some competent judges, the results of working the Dessau retort conclusively show that what was previously not absolutely capable of proof has now been established—viz., that the cyanogen content of ordinary coal gas is the result, not of direct combination between carbon and nitrogen (as in the lower zones of the blast-furnace in the presence of an alkali metal, potassium, or its carbide), but is produced at the expense of ammonia, already formed, by the latter meeting with highly incandescent carbon on its way out of the retort ($NH_3 + C = HCN + H_2$). A possible alternative hypothesis for the method in which hydrocyanic acid is formed in the retort at the expense of ammonia has been recently brought to my notice by Mr. W. H. Coleman—viz., by the reaction of ammonia upon marsh gas ($NH_3 + CH_4 = HCN + 3H_2$). I have already drawn attention to the careful observations of Mr. Bury upon the proportion of marsh gas diminishing steadily with rise of temperature in the coke-oven; and I may refer to the tests of Mr. Short, in the table. It is a subject quite worthy of investigation, therefore, whether at certain temperatures, and, if so, under what conditions, this reaction takes place. Possibly the incandescent carbon may play the part of a catalyte at a temperature below that at which it is itself competent to take its own active part in the reaction.

The increase in yield of ammonia (about one-third) noted in the vertical retort can, however, if we accept the above figures, only be partially due to the lessened amount of cyanogen in the gases leaving the retort—intermittent or continuous—but must be in larger measure due to the fact that this product of destructive distillation when formed suffers far less loss by decomposition on its way out, owing to the conditions favouring such decomposition being much lessened in potency in the Dessau retort by the existence of the comparatively cool central channel during ammonia-evolution stage, and in the continuous retort to the fact that the products on their way out do not meet with a higher temperature than that at which they are formed.

During the course of 1908, it is hoped that opportunity will arise for study of the working of the continuous vertical retort designed conjointly by the late Mr. William Young and Messrs. S. & T. Glover, of St. Helens and Norwich, at the Corporation gas-works at St. Helens, erection of plant having been already commenced. An able survey of the present position, from the chemical point of view, of the relative advantages and disadvantages of the various systems of gas retorting, horizontal, inclined, and vertical, by Dr. Harold G. Colman, is to be found in a lecture by him to the Manchester and District Junior Gas Association on Nov. 23, 1907.*

The third paper that calls for notice here, contributed by Mr. E. M. Hann, M.Inst.C.E., to the South Wales Institute of Engineers, describes fully the installation of two blocks of regenerative coke-ovens with bye-product plant erected in 1905-7 by the Powell Duffryn Steam Coal Company at Bargoed, South Wales.† The coal coked here comes from two seams, the mixture as used in the ovens containing only 19·5 per cent., on an average, of volatile constituents; while the actual yield of coke appears to be 81·75 per cent., of which 80 per cent. is metallurgical coke and the remainder breeze. This yield is slightly over 1 per cent. more than is theoretically possible; and it results from certain of the tarry compounds in the gas being decomposed and depositing a part of their carbon on the hot coke. Mr. Hann observes that a large proportion of the bricks for both blocks, and the whole of those for the oven interior, were imported from Germany. It seems strange that, after years of knowledge of the wants of coke makers, the manufacturers in this country continue mainly to rely upon the properties of their clays in their natural condition, and do not call to their aid expert chemists and others to enable them to blend different materials in such a manner as to overcome the difficulties arising from expansion and other causes. This is the more remarkable in that the German makers sometimes obtain their raw material from Great Britain.

Even with this low volatile, tests made on the first block on several occasions show that only 50 per cent. of the gas is used in the oven flues, while 50 per cent. is surplus available for the production of power. The whole of the gas produced is purified by oxide of iron; this precaution being taken not only to remove from the gas sulphuretted hydrogen, but also dust, the source of various troubles in the working of gas-engines. The sulphur so recovered is one of the sources of supply required for the sulphuric acid plant; a portion of the balance needed being that contained in the sulphuretted hydrogen evolved in the sulphate of ammonia process.

The coals used vary, but an average content of ash would be about 20 per cent. This is reduced by washing to 6 per cent., and the average content of sulphur is reduced from 1·5 to 1·1 per cent. This equals about 25 lbs. of sulphur per ton weight in the coal going to the ovens. Of this, sulphur in the coke accounts for 0·72 per cent., or 18 lbs. It is found that from the liquor is obtained a quantity equal to 2·3 lbs.,* and from the oxide of iron purifiers 2·7 lbs. per ton of coal—leaving a balance of 2 lbs., accounted for partly as sulphur compounds in the gas not removed by oxide of iron purification, partly as thiocyanates and thiosulphates in the effluent spent ammoniacal liquors, and, in addition, what is contained in the coke breeze.

The combined yield of volatile sulphur supplied from the above-mentioned sources—spent oxide from the purification of the gas and the distillation of the ammoniacal liquor produced—is 5 lbs. per ton of coal, which Mr. Hann states appears in this particular case to be almost precisely the quantity needed to make into sulphate the ammonia in the coal—19·2 lbs. of sulphate per ton of coal coked. He also remarks on the subject of oxide purification of the gas: "Formerly the oxide could only be used once, but of late it has been found possible, by simply rendering it (the burnt oxide leaving the sulphuric acid plant) alkaline, to use it over and over, by which, of course, a notable saving of expense is made."

The average analysis of the gas produced from the ovens is shown in the table. It has a heat value of 460 B.Th.U. per cubic foot. The high percentage of hydrogen makes it peculiarly liable to pre-ignition by compression when the gas is applied for power generation in gas-engines. Mr. Hann says: "Great difficulty was experienced in getting any of the gas-engine makers to face the problem presented by the composition of the gas and the necessity for the very accurate governing for the purposes of the parallel running of the electric generators." He proceeds to describe the 1200-H.P. engine erected by the combined Augsburg and Nürnberg firms, which has yielded results so extremely satisfactory that the addition of a twin tandem four-cylinder engine to develop 2400-B.H.P. is now being made. The result of tests of the capacity of the above engine, worked out in its equivalent heat value of coal, is about 0·7 lb. of coal per indicated horse power. On the occasion of a recent visit to Bargoed, I was so much struck with the great smoothness of running and absence of explosion sounds in the working of this engine, that I requested permission to make some mention in this report of so remarkable a success, as being a subject of general interest to its readers. The yield of sulphate of ammonia is 19·2 lbs., and of tar 36·5 lbs., per ton of coal. In addition to the uses of the oven gas already named, that of contributing (after enrichment) to the supply of illuminating gas for the village of Bargoed should be mentioned.

The observations made by Mr. Hann, and quoted above, concerning the importance of securing certain qualities in the fire-bricks used in coke-oven construction, and on the difficulty (in many instances impossibility) of securing these essential characteristics in British fire-bricks, confirm the evidence given before the Royal Commission on Coal Supplies by Mr. J. H. Darby, of Brymbo. Experience has in the past been somewhat dearly bought in reaching the conclusion that chemical analysis of the clay or of the kilned brick is no certain guide to the behaviour of the brick in the coke-oven. Contraction under the varying high temperatures to which the oven is necessarily subject appears to be minimized in the bricks made from Belgian clays.

A further enemy to the oven brickwork is found in certain districts where the coal itself contains abnormal proportions of chlorides. At the heat of the oven, these react on the highly silicious oven lining, liberating hydrochloric acid, which subsequently combines with ammonia in the scrubbing and washing

* See "JOURNAL," Vol. C., p. 633.

† *Ibid.*, Vol. CII., p. 353.

* Mr. Hann proceeds on the assumption that all the sulphur in the liquor is volatile, and so available for sulphuric acid manufacture. This is not the case. Analysis of the liquors shows that only about two-fifths of the 2·3 lbs. is so available, or 0·8 lb. The remaining 1·5 lbs., therefore, or 30 per cent. of the total needful to make sulphuric acid equivalent to the ammonia, must be supplied from extraneous sources. Still, 70 per cent. is an excellent figure.—R.F.C.

plant, giving a liquor high in proportion of fixed ammonia due to the abnormal proportion of ammonia as chloride. In one recent example at a coke-oven works the oven linings rapidly became honeycombed, and relining of the whole series had to be taken in hand. Provision was made to wash the coals before use, so as to minimize the presence of chlorides. Unfortunately, the brick recommended (compressed brick, having considerably less silica and a larger amount of alumina than those used in the first lining) proved on use to possess a different, but very radical, fault—that of contracting and allowing air to be drawn into the ovens, burning the tar and gases, and forming abnormal quantities of naphthalene, besides depositing pitch in the gas-main and producing frequent stoppages in all parts of the system.

SOME RESULTS OBTAINED WITH AIR-WATER-GAS MOTORS.

By M. Camille Roche.

[A Paper read before the Société Technique du Gaz.]

In communicating the results obtained with gas-motors for the working of an electric installation, the writer confines himself to the arrangement of the gas-making plant, the choice of fuel, the reduction of impurities in the gas, and the means which may be taken to silence the working of the motors. The gas is produced by the action of a mixture of air and steam on an incandescent fuel, and may have a composition corresponding to the following:

Carbon monoxide	29·3 per cent.
Carbon dioxide	7·3 ,,
Hydrogen	22·0 ,,
Nitrogen	41·4 ,,

Theoretically the production of one cubic metre of gas requires 197 g. of carbon. In practice, the calorific power, measured in a Junkers calorimeter, gives a figure from 1100 calories for coke and 1330 calories in the case of anthracite; steam being reckoned condensed. In practice, using a boiler heated by the hot gas generated, there is never too much water produced under the grating of the gas-producer. It is, therefore, necessary to provide a boiler with the greatest possible heating surface, in order to obtain sufficient vaporization and a good cooling of the gas. The heating of the boiler with the hot gases is an essential part of the process; otherwise the advantage of recuperation is lost, and the gas is cooled. It is a mistake to place the boiler near to the furnace, where it absorbs heat from the direct combustion of the carbon. Calculation shows that to keep the furnace in a proper state of combustion 0·4 kilo. of water vapour per kilo. of carbon is required, after allowing for ash. In practice, 0·3 kilo. of water per kilo. of the raw fuel is found to be about right.

Anthracite is a suitable fuel if containing no more than 3 to 5 per cent. of ash, beyond which it is inconvenient in use. A more practical and cheaper fuel is coke, which gives 7000 calories per kilo., compared with 8000 calories for anthracite, though circumstances alter the calorific results obtained from the coke. The best method, therefore, is to add to the coke one-third to one-fifth of its weight of anthracite in order to secure the making of gas of constant quality. For this purpose anthracite dust may be used; the coke serving as a sort of sponge and distributing it throughout the mass. It is found that a mixture of the two materials works better than either alone; and with such a mixture a percentage of ash up to 12 or 14 per cent. does not prohibit the use of the material as it would in the case of anthracite alone. Bad results have been given on mixing the anthracite immediately before use. The fuel is then not homogeneous, and gives a varying make of gas. The same fuel, uniformly mixed, should be employed throughout the twenty-four hours.

As regards impurities, anthracite often contains 1 per cent. of sulphur, and coke 1½ per cent.; but it is found by analyzing the blackish mud collected in the syphon pot of the gas-producer and in the main that 35 to 40 per cent. of free sulphur is contained in it. The wash-water, when treated with lead acetate, gives a coffee-coloured precipitate of lead sulphate and sulphide, showing traces of sulphuretted hydrogen in solution. If lead acetate paper, placed in a current of the gas, darkens only very slightly in twenty-four hours, it may be taken that the sulphuretted hydrogen is present only in small measure. The sulphur contained in the gas is largely in the state of carbon bisulphide, which is not affected by the ferric hydroxides employed for the purification of coal gas. An approximate analysis of the gas showed that it contained 4·19 per cent. per volume of sulphur compounds. There is a strong odour of sulphurous acid at the outlet of the plant, showing that the greater part of the sulphur in the fuel has passed into the gaseous product, though it may be asked whether it is worth while to deprive the gas of it.

Both sulphuretted hydrogen and carbon bisulphide have a considerable calorific power; and from this point of view their presence in the gas is an advantage. As for any evil effect which they may have in the way of corroding the metal portions of the motors, cast-iron or bronze, it has been found that they have been totally without action, and that the motors have kept cleaner and worked better than with well-purified coal gas. There has been less occasion to clean the ignition chamber or to renovate the valves. An experiment has shown that sulphuric acid is not formed in the cylinder of a gas-motor, but only when a sulphurous gas cools in the presence of water. When this is the case, corrosion of the outlet tubes is rapid; and the use of water for the cooling of the burnt gases should, therefore, be avoided.

Next to sulphur, the other cause of wear and tear in the cylinders is dust in the gas. This may amount to several grammes per cubic metre, and will cause irreparable injury to the cylinders, which, in the case of several works, have had to be renewed at the end of ten or twelve months. The difficulty can be got over by means of a ventilator of the armature type supplied with a strong current of water, against which the gas comes, and by which it is deprived of its suspended matter. It is sent forward to the motors with only 0·5 to 0·8 gramme of fine dust per cubic metre—a quantity which will have no injurious effect. It is different in the case of gas-producers fed with coke or anthracite; and it has been found that dust does not reach the cylinder of the motor, and that in other parts of the system it has no dangerous action. It has been found that there are three points at which the suspended matter in the gas is liable to collect—*i.e.*, at the outlet of the gas-producer, on the plates of the washer, and at the inlet syphon of the motor.

The black mud due to this suspended matter is plentiful in the syphon at the outlet of the gas-producer. In the case of the washer, the mud deposits successively in the various sections. A thorough cleaning of the washer is necessary when the upper sections are found to contain it. In the tube leading from the washer to the motor, we have never been able to find mud further than the bottom of the syphon next to the motor. This syphon, of 250 m.m. diameter, placed directly at the inlet to the motor, is as clean as on the day of its installation. This is after two years of use; and it has never collected any mud.

Methods have been tried to silence the noise of the exhaust, but without any very satisfactory results. Some attempts have been made to use a brick chamber of large size. This chamber deadens the noise very well; but its size involves considerable danger. After a number of misfires in the cylinder, it may become charged with unburnt gas, and give rise to an explosion. Water may be injected into the exhaust. The water vaporizes, cools, and contracts the gases, and the noise of the exhaust is reduced; but the water vapour has the great drawback of leading to the formation of sulphuric acid, which rapidly corrodes the metal surfaces.

A silent exhaust is obtained by allowing the burnt gases to expand into three successive vessels connected by a suitable system of tubes; the whole being made in cast-iron strong enough to withstand explosion. The following details may be cited as a guide to the use of this method: The total volume of the exhaust, vessels, and connections should be between 12 and 13 times that of the cylinder. The first and second vessels will be identical and equal to 2½ times that of the cylinder. The third should be larger—five to seven times the size of the cylinder. The second and third vessels should be filled with broken flints or pieces of old retorts. These materials slow down the stream of gas, and reduce the dangerous volume in the case of misfires. The tubes connecting the three vessels should have the same diameter as those of the motor exhaust. In these conditions, the pressures will not exceed 3 m. to 4 m. of water at the first two vessels, and 0·2 m. to 0·3 m. at the third vessel; and the silencing will be quite satisfactory.

Society of Arts.—At the first meeting of the new Council of the Society of Arts on Monday last week, Sir William White, K.C.B., was elected Chairman for the current year.

Death of an Old South African Gas Official.—We regret to learn, from a copy of the "Port Elizabeth Advertiser" for the 20th ult. just to hand, of the death, on the preceding Thursday, of Mr. John Armour, who for upwards of twenty-two years held the position of Secretary of the South African Lighting Association, and did a great deal towards advancing its business. Deceased was highly esteemed throughout Port Elizabeth; and his widow has received in her bereavement the sympathy of a wide circle of friends. The funeral was largely attended; all the public and local bodies being represented.

Gas Companies' Accounts for 1907.—We have received from Messrs. John Allan and Co., the "'Gas World' Analyses of Gas Companies' Accounts for 1907." Readers are aware that for the past few years the above-named firm have issued yearly an analysis of the accounts of a number of companies and local authorities. Owing, however, to the different dates fixed for making up the accounts of the two classes of undertakings, some of the figures were rather old before they were published. This led to a separation of the companies, the statistics in regard to which are now issued. The accounts of 55 gas companies are analyzed; the results occupying two large linen-backed sheets. On one of these will be found particulars relating to the coal carbonized, the percentage of carburetted water gas produced, the quantity of gas made, sold, and unaccounted for, statistics of revenue, &c.; while on the other are given the distribution and management charges, bad debts, the net cost of gas, mileage of mains, number of consumers and public lamps, total capital and capital per ton and per 1000 cubic feet, reserve funds, &c. The book is similar in appearance to its predecessors, and the price is 10s. 6d. net.

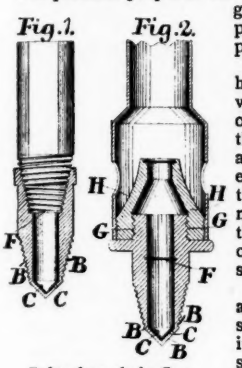
REGISTER OF PATENTS.

Gas-Burners.

POLESCHOWSKY, J., of Wood Green, N.

No. 17,632; Aug. 1, 1907.

The patentee proposes the arrangement shown, in order to keep the gas passing through a burner at uniform pressure, irrespective of any increase of pressure in the main.



Poleschowsky's Gas-Burners.

For ordinary lighting (fig. 1), the socket has one end B tapered, and provided with minute holes C at an angle to each other. There is a gauze screen F within the socket. For incandescent lighting, as fig. 2, the construction is the same, except that a screw-thread G is made on the outside of the open end for attachment of the nipple H, and on to which the casing I forming the mixing-chamber or burner is affixed. The nipple H has a second wire gauze J.

The gas from the supply pipe acts against the coned or flat end B of the socket, and passes through the holes C in streams meeting one another in the socket before it reaches the wire gauze F, and being divided in passing through the gauze before reaching the burner or nipple H, whereby "the gas is retarded and can only pass to the burner at one rate of speed."

Recording the Flow of Fluids in Pipes.

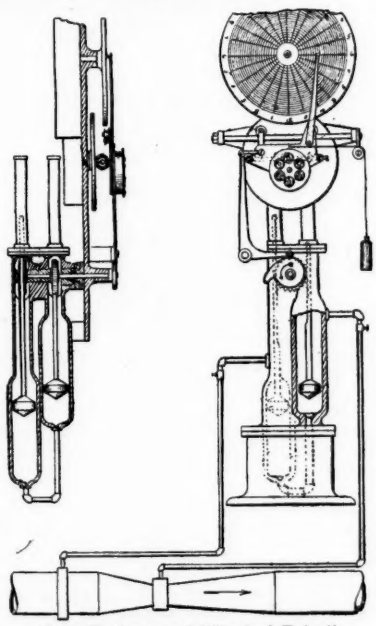
CONNET, F. N., of Providence, R.I., U.S.A.

No. 18,064; Aug. 8, 1907.

This invention relates to meters adapted for use with the "Venturi-Tube" method of ascertaining the rate of flow of a fluid through a pipe—a class of meter that is generally adapted to record graphically the variations of flow of the fluid and to indicate the total volume of fluid that has passed through the pipe in a certain time.

In one form of such meter, a U-tube is employed having the upper ends of each arm connected respectively to the throat and up-stream of the venturi-tube. Within the U-tube mercury is placed; and a float is located within one arm having a flexible driving connection with the recording mechanism. According to the variations in the rate of flow of the fluid passing through the venturi-tube, the pressure upon the mercury in the U-tube correspondingly varies; and in consequence the level of the mercury also varies—thus causing the float to have an up or down movement, which is transmitted to the recording mechanism. It has also been proposed to employ two tubes containing water, connected at their lower ends to the throat and up-stream of the venturi-tube respectively; and on the top of each water column there rests a float having a flexible driving connection with the recording mechanism.

The object of the present invention is to provide improved means for operating the recording mechanism of a meter of this type, and to improve certain details of the integrating mechanism.


Connet's Improved "Venturi-Tube."

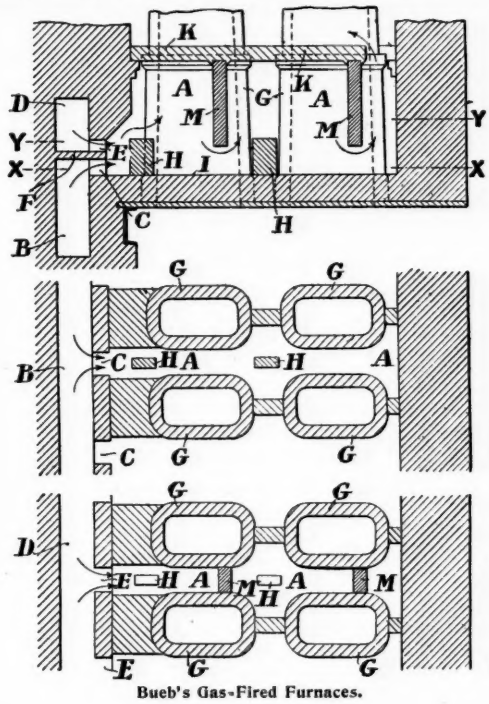
As shown, there is a pair of cylinders adapted to contain mercury and normally communicating with one another. In each cylinder is a float having a stem on which a rack is formed. These racks are adapted to gear at opposite sides with gear-wheels rigidly mounted upon a cam-shaft having bearings in the upper ends of the cylinders—the floats thus together driving the shaft in the same direction. The cam, through the medium of a bell-crank lever or other connection, operates the stylus and counter of the recording mechanism in the already well-known way. In order to facilitate the movement of the contact-wheel of the counter across the face of its driving disc, a series of auxiliary wheels is adapted to be carried by the contact-wheel at right angles to it, so that when the contact-wheel is moved across its driving disc, an auxiliary wheel contacts with the disc and rolls thereon—thus preventing any undue wear taking place. The contact-wheel is also adapted to be driven through a flexible coupling, and is carried by a spring-pressed plate so that it may be automatically moved to contact with its driving disc as wear takes place.

Gas-Fired Furnaces.

BUEB, J., of Dessau, Germany.

No. 26,590; Dec. 2, 1907.

This invention relates more particularly to the heating of retorts by producer gas, and has for its object to enable the manner in which the heat is applied to the retorts to be regulated. The gas and air enter the combustion-chamber in approximately parallel streams, and "the blending of these currents and the obtainment of variations in the intimacy of the mixture thereof and in the resultant heat is effected by the disposition in the combustion-chamber of bricks or the like which constitute baffles, the position of which can be adjusted."



Bueb's Gas-Fired Furnaces.

A furnace provided with vertical retorts and constructed in accordance with this invention is given by way of example—a vertical section through the combustion-chamber showing the inlet and outlet passages, a section on the line X, and another section on the line Y.

Producer gas is supplied to the combustion-chamber A through a passage B with horizontal openings C; air being supplied through a corresponding passage D having similar openings E. The passages B and D are separated from each other by a partition F; and their openings are thus approximately parallel. The retorts G are disposed in the combustion-chamber A in two series—one behind the other. Between each pair of retorts air and gas are introduced in parallel streams through the openings E and C, and travel in approximately parallel streams—first striking against a baffle H placed on the hearth I of the combustion-chamber, with the result that some portion of the streams are mixed, and combustion is started. The gases deflected upwards by the first baffle H are then directed downwards by a depending baffle M, projecting downwards from the roof K of the chamber. They now impinge against a second adjustable baffle H, and are more intimately mixed, so that further combustion takes place.

By means of a second depending baffle M, the hot gases are again directed downwards, so as to come into contact with the lower corners of the outer retort G; the gases finally escaping upwards, as indicated by the arrow. In this way, by employing several baffles, placed loosely on the hearth, preferably alternately with depending baffles M, it is possible to regulate as desired the intimacy of the mixture and the manner in which the heat is applied to the retorts. Thus, for example, by moving the first baffle towards the gas and air openings, it is possible to obtain a more intimate mixture, and, consequently, a more vigorous development of heat as soon as the gases enter the combustion-chamber; while the movement of the first baffle away from the openings has an opposite effect.

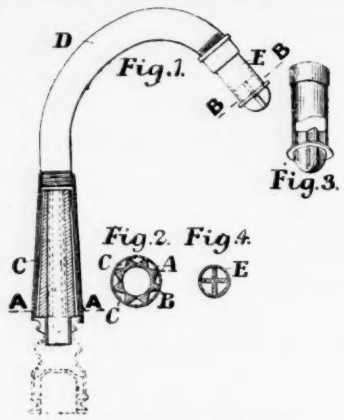
Incandescent Gas-Burners.

ROBERT, M. A., of Marseilles.

No. 27,490; Dec. 12, 1907. Date claimed under International Convention, Dec. 12, 1906.

This invention relates to an arrangement of mixing device applicable more particularly to "intense" or high-pressure inverted burners. The device, "owing to its particular disposition, provides for the best conditions of mixture of the air and gas from which a maximum

luminous intensity for the mantle is obtained; it also suppresses oscillations, assures fixity of the light, and finally prevents ignition of the mixture in the interior of the tube, and avoids carbonization and fouling owing to the complete combustion of the gas."



Robert's Incandescent Gas-Burner.

Fig. 1 is a vertical sectional elevation, taken on the axis of the device. Fig. 2 is a horizontal section on the line A. Fig. 3 is a perspective view of the burner (broken away to show the interior). Fig. 4 is a horizontal section of the burner on the line B.

The mixing device comprises two concentric tubes cast in one or soldered together. The interior tube is made with a number of channels forming air-flues, and preventing return of the flame or the ignition of the mixture at the gas-nozzle at the base of the tube. These tubes of tapering form therefore present between them a series of spaces C of less section at the top than at the base. Within the exterior tube a tube D is screwed, and curved to any suitable form. This curved tube terminates in the burner E, which may be of different sections. Openings G are formed in the external tube to allow for the entry of secondary air through the spaces C, and to be incorporated with the mixture of gas and primary air issuing by the upper orifice of the internal tube.

The same arrangement may be utilized with upright burners by dispensing with the curved tube D, and directly screwing the burner upon the external tube.

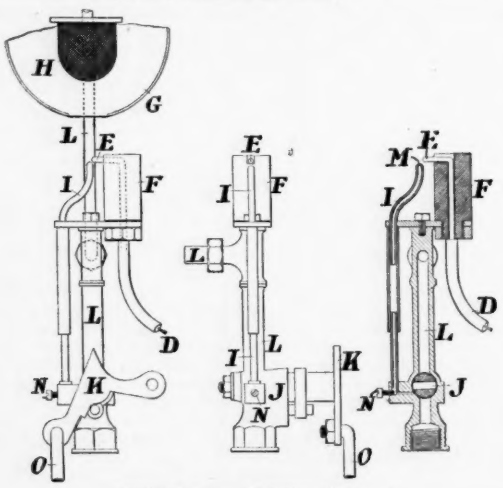
Ignition Devices for Inverted Incandescent Street Lighting Burners.

COTTON, F. T., of Dublin.

No. 10,856; May 19, 1908.

This invention relates to an electric ignition device for inverted incandescent gas-burners as used in street lamps or lanterns, and is a development of the invention described in patent No. 6048 of 1903.

The contact device described in connection with upright burners in the prior patent is also employed in the present invention, and is fitted at a convenient height in the lamp-column. The device consists of a central brass stud from which an insulated wire D is carried up through the base of the lamp, and is connected to a copper wire terminal E fitted in an ebonite body F. The terminal is arranged directly under the centre of the globe of the burner at a distance of about 7 inches from the open bottom of the globe, and is permanently arranged at sparking distance from the orifice M of a small brass bye-pass tube I mounted in connection with a specially-designed gas-cock J.



Cotton's Lamp-Lighting Device.

The cock is so constructed that, when its lever K is pulled down slightly, the gas begins to pass into the burner supply pipe L, and at the same time passes through the bye-pass tube to the orifice M at the sparking gap, near the electrical terminal E. When current is caused to pass from the contact stud to the sparking gap, the gas issuing from the orifice of the bye-pass tube I is instantly ignited; and the jet or flame thus produced serves to instantly ignite the gas supplied to the main burner. As soon as the burner is lighted, the lever K is pulled down to its full-open position; this movement closing the bye-pass and extinguishing the bye-pass jet or flame, which is regulated in length by a small adjusting screw N, so as to reach within about an inch of the open bottom of the globe.

The gas-cock J is controlled by a connecting rod O, attached to one arm of the lever K, and terminating (at a convenient height upon the lamp-column) in a slotted handle freely slidable upon a set-screw fixed into the column; the length of the slot being calculated in accordance with the range of movement of the lever K.

For the electric ignition, a portable box is provided, containing a four-volt accumulator and induction coil. The contact device fitted at one end of the box consists of a central brass stud with a spring, an outer semicircular contact-piece, and an intermediate insulation. By raising the box and applying its contact device to the corresponding contact device in the lamp-column, and slightly pressing the box towards the column, the spring is depressed and the circuit closed. A current therefore passes from the battery box, by way of the wire D, to the terminal E, and sparks across the gap to ignite the gas as described.

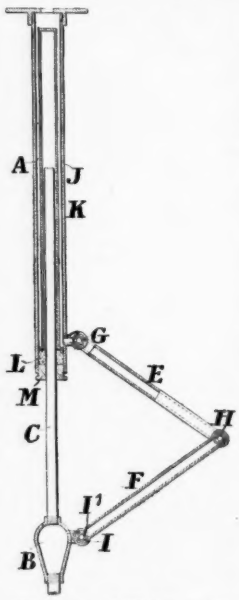
The patentee claims that his invention ensures immunity from breakage or damage to the lantern or mantle of the lamp, so largely experienced with other methods of lighting. The shocks and vibration produced by trap and pole lighting are especially obviated. There is no trap required in the lantern; so that the lantern remains comparatively dirt and dust proof. The lamplighter performs all his operations for lighting the lamp at least 4 feet from the bottom of the lamp, and is therefore able to do the work of his district more speedily.

Gas-Light Pendants.

CHANDLER, S. & J., of Brixton, S.W.

No. 6365; March 21, 1908.

This invention relates to gas-pendants having a fixed gas-supply chamber connected by jointed folding arms (through which the gas passes on its way to the burners) to a movable burner chamber which can be raised or lowered in a vertical line without the use of any liquid seal.



Chandler's Self-Adjusting Gas-Pendant.

The gas supply is in communication with an annular chamber A closed at its lower end, and the pendant burner with a chamber B closed at its upper end by a rod or closed tube C extending upwardly and guided centrally within the inner wall of the chamber A. Both chambers are connected by a pair of jointed tubes E F (closed at their respective ends), pivoted to each other and to the chambers A B, or to lateral branches extending from them, by means of the hollow plugs G H I. The bores of G and H open into the ends of the tube E; while the bore of the plug I opens into the lateral branch from the chamber B. The whole arrangement is such that for any elevation of the pendant there is a clear passage for gas from the chamber A to the chamber B through the tubes E F and their connecting pivots.

The chamber A is formed between an outer tube J and an inner tube K; the latter being closed at the top and forming the guide for the pendant rod C, and being flanged at its lower end. The flange serves to close the lower end of the Chamber A, and also (in conjunction with the open end of the outer tube J) forms a stuffing-box for the reception of packing L, which, by means of the gland M, can be expanded so as to ensure the closing of the chamber A, or to retain the pendant frictionally at whatever elevation it may be set.

Gas Retorts, Ascension Pipes, and Hydraulic Mains.

RIES, H., of Munich.

No. 2116; Jan. 30, 1908.

This invention relates to hydraulic mains for gas-making apparatus of the type wherein compressed gas is employed to regulate the level of the liquid, and so immerse or uncover the dip-pipes—a three-way cock positively connected to the retort cover controlling the supply of compressed gas to the main.

The valve which controls the supply of compressed gas to the hydraulic main comprises two bells pivotally mounted within a gas-tight casing connected to the compressed gas supply, the hydraulic main, and the auxiliary chamber. Each bell is provided with a liquid seal, into which one or other of them is caused to dip and thus establish communication between the compressed gas supply pipe and the auxiliary chamber, or between the latter and the hydraulic main whenever the dip-pipe covers are opened or closed. The dip-pipe covers are operatively connected to the valve, and the covers of the retorts are similarly connected; so that one valve is employed to control the supply of compressed gas to the auxiliary chamber of the hydraulic main, and thus ensure the immersion of the dip-pipes, either when the covers of the dip-pipes or of the retorts are removed.

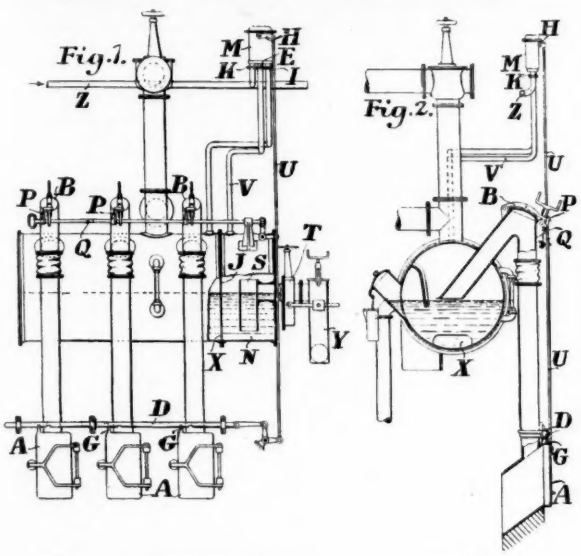
Fig. 1 shows an elevation (partly in section) of a hydraulic main, together with the ascension pipes and retort covers. Fig. 2 is a vertical cross-section of the device. Fig. 3 is a vertical longitudinal section of the valve employed, also a vertical section and a horizontal cross-section of it.

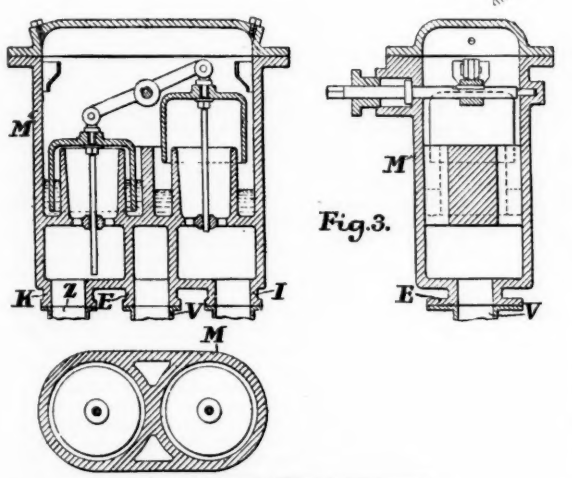
The hydraulic main into which lead the dip-pipes is connected to the ascension pipes as usual. There is also provided an auxiliary chamber

or main N, which is separated at the top from the hydraulic main proper by a partition J, but is in communication with it at the bottom by means of an opening X. The auxiliary chamber is connected by a trap or syphon S with the tar-discharge pipe T having a closing syphon Y.

The change of the level of the liquid in the hydraulic main is effected by gas under pressure. For instance, gas from the scrubber installation is introduced into the auxiliary chamber N, and forces liquid, through the opening X in the partition J, to the hydraulic main. The level of the liquid in the chamber is lowered in accordance with the pressure of the gas; and a certain quantity of liquid is thus displaced, passing into the hydraulic main and raising the level of the liquid therein in proportion to the volume of the liquid in the main and chamber N. If the proportions of the gas pressure and the volume of liquid in the main and chamber are properly selected, the rise can be adjusted in such a manner as to ensure the immersion of the dip-pipes, to prevent, for instance, the gas from flowing back if the covers of the ascension pipes be open. The escape of the compressed gas at the tar outlet is prevented by the syphon pipe or trap V.

The admission of compressed gas is controlled by a valve M connected by a branch K to the compressed gas supply pipe Z, and also by a branch to the pipes leading to the auxiliary chamber and hydraulic main respectively. If the valve M is actuated so that compressed gas





Ries's Hydraulic Main Arrangement.

passes from the pipe Z into the auxiliary chamber N, the level of the liquid in the main will rise and bring about the immersion of the dip-pipes. If, on the other hand, by moving the valve so that the pipe Z is not put into communication with the chamber N, and the chamber is in turn put into communication with the hydraulic main, the pressure will be balanced, and the level of the liquid in the chamber N will rise, while the liquid in the hydraulic will sink to such an extent that the dip-pipes will be no longer immersed.

The arrangement is such that the valve has its lever H connected by a rod U to the ascension pipe covers B, and the valve is also positively connected to the retort covers A so that the covers B and A cannot be opened without the valve M being operated to insure immersion of the dip-pipes. To this end, the rod U is connected by a bell-crank lever to a rod Q having an operating handle at one end and projections P which hold down the ascension pipe covers, so that the latter can be opened only when the rod Q is moved to the left, and, consequently, the valve M moved by the bell-crank lever to admit compressed gas into the chamber N—the level of the liquid in the hydraulic being thus raised until the dip-pipes are immersed. In the same way, the covers of the retorts are provided with projections G held down by a rod D. The doors can be opened only when this rod is pushed to the left to such an extent that its recesses release the projections G. Owing to this movement of the rod to the left, the valve M is moved by a bell-crank lever and the rod U in such a manner that the immersion of the dip-pipes in the hydraulic is again ensured by the compressed gas entering the chamber N.

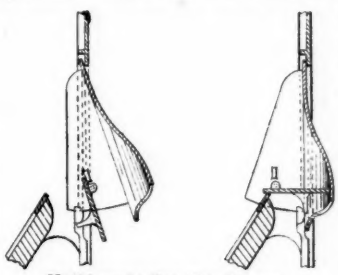
The valve M, shown in fig. 3, comprises a casing closed in a gas-tight manner and provided at the bottom with a liquid seal of mercury. Mounted within the casing are two bells suspended from the ends of a double-armed lever pivoted about a pin; the bells being adapted to dip alternately into the mercury forming the liquid seal. To the branch K of the casing is connected the compressed gas supply pipe Z; the pipe V leading to the auxiliary chamber N being connected to the branch E, and the pipe leading to the hydraulic main being connected to the branch I. When the bells are in the position shown, the pipe leading to the hydraulic is in communication with the pipe V leading to the auxiliary chamber N, so that there is an equilibrium of pressure between the two chambers. When, however, one bell is raised, and the other one lowered, the compressed gas supply pipe Z is placed in communication, by means of the branch K and valve casing, with the pipe V leading to the auxiliary chamber N, whereby the level of the liquid in the hydraulic is raised as already described.

Canopies for Gas-Fires.

MATHIESON, W., of Leeds.

No. 2844; Feb. 8, 1908.

This invention relates to cowls or canopies for gas stoves and fires operated in conjunction with a hinged plate or damper for the purpose of regulating the size of the opening into the flue. As shown, it is a combination with a movable canopy of a movable plate or damper, which, when the canopy is full open, gives a larger flue space, and when shut, closes or obstructs the flue space—the plate working automatically with the movement of the canopy or the like. The illustration shows a portion of a stove with the cowl and plate open and closed respectively.



Mathieson's Gas-Fire Canopy.

APPLICATIONS FOR LETTERS PATENT.

13,693.—EAVES, T., "Incandescent burners and anti-vibrating devices." June 29.

13,705.—WEBB, L. S., "Gas-stoves." June 29.

13,752.—KITSON, A., "Incandescent vapour lamps." June 29.

13,753.—JABS, A., "Gas-producers." June 29.

13,754.—EDDRUP, E. C. P., BOUGHTON, H. F., and EVERSON, W. H., "Incandescent gas-lamps." June 29.

13,765.—MEYERSBERG, G., "Engines driven by a mixture of gases and liquid." June 29.

13,772.—BÉNARD, P., "Automatic distributor for gas controlled valve." June 29.

13,828.—REESER, H., and BRAY, H. E., "Metallic mantle." June 30.

13,852.—DELAGE, M., and WOOG, P., "Incandescent gas-lamps provided with electric ignition." June 30.

13,873.—ROWLAND, J. D., "Gas-burners." June 30.

13,912.—SUTTON, C. J., and RUDD, J., "Gas and air regulator for incandescent burners." July 1.

13,932.—SHARP, W., "Gas-regulating nipple." July 1.

13,936.—GOODWIN, W., "Couplings for pipes." July 1.

13,988.—JANES, G., "Utilization of the heat of combustion of gaseous fuel." July 1.

14,005.—CAMPBELL, V. E., "Automatic gas cut-off." July 1.

14,006.—FEWINGS, L. St. C., and CURTIS AND HARVEY, LTD. "Mantles." July 1.

14,034.—JOHNSON, J. C., "Gas-producer." July 2.

14,061.—WIGLEY, A. C., and ROWE, J. J., "Incandescent burners." July 2.

14,089.—MOORE, H., "Instruments for measuring and regulating temperature." July 2.

14,110.—HOLROYD, J., "Air-gas plants." July 3.

14,145.—HOWES, J. T., "Gas-meters." July 3.

14,165-6-7-8-9.—PARKER, T., "Destructive distillation of coal." July 3.

14,170.—PARKER, T., "Lifting apparatus." July 3.

14,205.—BEAL, W., "Shade or smoke consumer." July 4.

14,239.—MERCER, A., and METERS, LTD., "Gas-meters." July 4.

14,253.—SKAIFE, C., and GIBSON, J. A., "Incandescent burners." July 4.

APPLICATIONS FOR RESTORATION OF LAPSED PATENTS.

The WESTMINSTER LIGHTING, HEATING, AND VENTILATING COMPANY, LIMITED, have made application for the restoration of the patent granted to J. F. SIMMANCE and J. ABADY for an invention for "Improvements in street-lighting apparatus," No. 19,477, dated Sept. 28, 1899, which expired on Sept. 28, 1907, owing to the non-payment of the prescribed renewal fee. Any person may give notice of opposition to the restoration, on or before Sept. 8, 1908.

The WESTMINSTER LIGHTING, HEATING, AND VENTILATING COMPANY, LIMITED, have made application for the restoration of the patent granted to J. F. SIMMANCE for an invention for "Improvements in apparatus for the lighting and extinguishing of gas-flames," No. 8055, dated May 1, 1900, which expired on May 1, 1905, owing to the non-payment of the prescribed renewal fee. Any person may give notice of opposition to the restoration, on or before Sept. 8, 1908.

The Deputy-Mayor of West Ham (Mr. Stables) recently opened a seven-acre playing field leased by the Gaslight and Coke Company to the Rev. T. Given-Wilson, for development as a sports ground for his overcrowded parish.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Bywater's Paper on Refractory Material. The Need of a Central Laboratory and Testing-Station.

SIR,—Mr. Bywater's paper, and the remarks he makes on the necessity for proper testing of refractory materials, has brought to my mind again the idea that immense benefit would be conferred on the gas industry in this country by the establishment of a central laboratory and testing-station, the funds for which should be subscribed by gas undertakings throughout the kingdom. The engineers of large works are fortunate in having at their command the necessary apparatus, and the expert assistance required; but the majority of engineers of medium-sized works have to be content if they can carry out the ordinary tests for illuminating power and purity, &c.

For example, in buying coal it is important that one should know the percentage of ash and sulphur contained in it. If benzol is used, the amount of sulphur it contains and the proportion which distils over at a certain temperature should be determined. Incandescent burners and mantles could be tested; and perhaps in course of time we should have a complete coal-testing plant on a working scale, where all coals would be tested under the same conditions. If a small model works formed part of the scheme, problems of vital interest to all of us could be investigated much better than by costly experiments on a larger scale in each individual works.

A further advantage of the establishment of such a laboratory and testing-station would be that it would afford an opportunity to the students in the gas profession of learning scientific methods of research; and we should in years to come, with engineers so trained, not find it necessary to go to Germany for the best system of carbonization, the best retort, or the best inverted lamp.

W. W. TOWNSEND,
Engineer and Manager.

Hereford, July 11, 1908.

Daylight Saving and Gas Loss in South Africa.

SIR,—Referring to the daylight-saving scheme that is now before Parliament, I may say that in 1903 the powers that be in the Cape decided that throughout the Colony one universal time should be established, instead of the local time according to the sun; and they arranged it so that at 12 o'clock at noon, Greenwich time, it would be 1 30 p.m. out here—1½ hours difference from Greenwich time. Cape Town time was then about three-quarters of an hour different from that of Kimberley; and, similarly, every town had its own time according to its position—the towns being situated at great distances from each other. At Port Elizabeth, much to our sorrow from a gas-output point of view, we had to put our clock back some 40 minutes, which lost us some of the cream of the consumption. During the winter, it was dark here at five o'clock; so that all shops and offices had to light up until six (practically all business is finished at this hour). But when the change was made, five o'clock became ten minutes past four, and six o'clock ten minutes past five. Hence little light was required for business purposes, and few lit up; and I found that we lost the consumption of some 15,000 cubic feet of gas per day on a daily output of 250,000 cubic feet. This meant a winter loss of output to us of some 2 million cubic feet; and so it has continued until the present time. We gained nothing in the morning, as it is always light at seven o'clock in our winter time. We wish now that the clock could be moved 40 minutes forward, to help us in these dull times, when business is so bad.

We out here have very little luck (?) in the shape of juicy wet dark fogs. We seldom feel cold, have no continuous rainy days, and no snow; and we have, as described to me the other day, the beastly sun shining every day and all day long. It sounds funny for a complaint, does it not? With these conditions, a gas man has little show in big outputs. We have our rains in summer and very few in winter. They are very heavy, but soon pass off; and there is not much difference between our summer and winter output of gas. It is now mid-winter with us. Under these circumstances, many will say that we are like King Kama in "Princess Ida"—we "just grumble because we have nothing whatever to grumble at."

WILLIAM ARNOTT,
Manager, South African Lighting Association, Limited.

Port Elizabeth, South Africa, June 22, 1908.

Temporary Interruption of Gas Supply.

A correspondent writes inquiring whether there are any precedents in Acts or Provisional Orders for relief from the obligation to continue to supply gas at times when it is necessary to make structural changes in the distributing system of any particular locality between sunrise and sunset. We do not remember any such precedent; but if any readers have any information on the subject, it would be useful to have it on record.

The "Daily Mail" Puff.—Mr. J. Gaunt, of Aberystwyth, writes to point out that, in his letter on the above subject in the last number of the "JOURNAL" (p. 51), the words "ten 8-candle power lamps" should have been "eighteen 10-candle power lamps;" and that the comparisons of candle power for candle power should have been "½d. for gas against 1d. for electric light."

For the purpose of providing a public water supply to the village of Wormbill, the Chapel-en-le-Frith Rural District Council have received the sanction of the Local Government Board to borrow £3000. At present the villagers are dependent on a public well for their water supply.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill brought from the Commons, read the first time, and referred to the Examiners: Holderness Water Bill.

Bills read a second time: Blackburn Corporation Bill, Liverpool Corporation Bill, South-West Suburban Water Bill.

Bills reported: Camborne Water Bill, Wolverhampton Corporation Bill.

Bills read the third time and passed: Camborne Water Bill, Garw and Ogmore Gas Bill, Gas Orders Confirmation Bill, Gas and Water Orders Confirmation Bill, Rhymney and Aber Valleys Gas and Water Bill, Swinton and Mexborough Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Gas Orders Confirmation Bill, Gas and Water Orders Confirmation Bill, Rhymney and Aber Valleys Gas and Water Bill.

Lords Bills read a second time and committed: Ammanford Urban District Council Water Bill, Wath and Bolton Gas Board Bill.

Lords Bill reported; Bognor Gaslight and Coke Company Bill.

Bills read the third time and passed: Briton Ferry Urban District Council Bill, Holderness Water Bill.

The Ammanford Urban District Council Water Bill and the Wath and Bolton Gas Board Bill have been referred to a Select Committee, consisting of Mr. Rose (Chairman), Mr. John Rutherford, Mr. H. C. Lea, and Mr. Welsh; to meet next Thursday.

HOUSE OF COMMONS.

Monday, July 6.

COAL MINES (EIGHT HOURS) BILL.

The debate on the amendment submitted by Mr. J. Mason to reject the motion for the second reading of this Bill was resumed.

Mr. F. E. SMITH said a charge of inhumanity had been brought against those who opposed the Bill, because its object, according to the miners' representatives, was the limitation of the output of coal in order to increase the wages of the miners. When it was found that the consumers would have something to say against the restriction of output, hon. members shifted their ground, and stated that the Bill was brought forward in the interests of the unemployed. The economics of both these proposals having excited derision, the miners' representatives fell back in despair on the plea of humanity. They were told that because the miners in the country all wanted the Bill, they ought to have it. He disputed the premises and still more warmly the conclusion of such an argument. In that House they were told that if the men worked shorter hours they would work harder, and the output would not be reduced. This was not the argument used to the men themselves. The question put to them was: "Are you in favour of obtaining the same wages for shorter hours of work?" and wherever that question had been asked, it had been answered affirmatively. The question he had to put to himself was: "Why should my constituents, some of whom work ten, twelve, and fourteen hours a day, pay a higher price for coal in order that miners may have more leisure?" The humanity argument had been shattered and destroyed by the report of the Home Office Committee.

Mr. HERBERT SAMUEL denied that he had charged hon. gentlemen opposite with inhumanity; but he certainly charged them with gross inconsistency in opposing the Bill. The Government were not prepared to accept as correct the estimate of the coalowners as to the cost arising from the passing of the Bill. Their statement that the increased cost of coal would be from 1s. 6d. to 2s. per ton had been challenged again and again. The Departmental Committee had been rightly praised by both sides of the House. After carefully considering the evidence, they unanimously declared that the suggestion of 1s. 6d. or 2s. per ton increase could not be accepted, since it was far beyond the mark. The hon. member for Gloucester had asked two questions: (1) Would the Bill as proposed to be amended by the Government lead to a temporary shortage, which, though small in amount, might have the effect of raising the price of coal for a time to an exorbitant figure? (2) Would it lead to a permanent but small rise in price? Both of these questions had been answered in the negative; but an amendment had been suggested in two further particulars, which in no way touched the essence of the Bill. The hon. gentleman would like to see the eight-hours day established in three steps instead of two within five years. He also proposed that at the end of the five years there should be, not an eight-hours day *plus* one winding, but a 7½-hours day *plus* two windings. There was no difference in substance, but only a slight difference in administration. These two suggestions would, of course, receive full consideration in Committee. The member for the Walton Division (Mr. F. E. Smith) had asked why the miners should have the benefit of this legislation. If hon. members took into account the severity of their labour, the extreme danger of their occupation, and the discomfort of working below ground, there were no men in the whole country who could claim to be so greatly in need of a full measure of leisure; and for twenty years this legislation had been asked for by the miners. This was not merely a national movement; it was an international movement. Already the hours of labour in mines were shorter in other countries than they were in Great Britain. The alternative to this Bill seemed to be a coal strike, involving suffering for the women and children, dislocation of trade, and in the end the men probably starved

into submission. This was the policy suggested by the Opposition. The policy of the Government was the Bill before the House.

Mr. KEIR HARDIE said the Bill had been met with a degree of opposition which, apart from licensing measures, was unparalleled in his experience of parliamentary measures. Nobody need have any fear as to the coal trade being in danger in consequence of the passing of the Bill; and a statement which had been circulated to the contrary effect was a bit of political "bluff" intended to frighten timid members into voting against the measure. Even supposing that the operation of the Bill did cause a slight increase in the cost of production, he contended that this should be borne by the colliery owners, who for the past fourteen years had been making enormous profits. If there were to be a strike over the Bill, it would mean that every colliery in Great Britain would come to a standstill until eight hours for work had been won.

Mr. MARKHAM remarked that if the Bill came into operation, the effect of it, so far as South Wales was concerned, would be very serious, and there would undoubtedly be a large reduction in the output of coal. He did not believe that the profits in coal mining were more than 6 per cent. on the capital involved—at all events, they were not in the collieries with which he had been associated during the past twenty years; and he believed the Bill would increase the cost of coal on an average by 6d. a ton. The coal owners would have to raise the prices by 1s. a ton to meet this extra cost.

Mr. BONAR LAW said every one who had spoken had confined himself to an appeal to the humanity of hon. members. This was strong ground; but the fact that there were other men who worked nearly twice as long as miners, for less than half the wages, suggested that possibly the humanity might be on the other side. Were the hours of miners excessive? The Committee on this question reported that there was no justification for the Bill on the ground of health. It was perfectly true that mining was dangerous; but the Bill, so far from mitigating these dangers, would probably increase them. He did not deny that the miner's life was a hard one; but the labourers in steel and iron works had a far harder life. The Home Secretary, replying to a deputation, said it was impossible to settle this question between the masters and men because of the immense variety of the methods of working mines in different parts of the country. But was it possible to find any words which more strongly condemned the Bill? Supposing they passed the Bill, what would its effect be on the country; or, in other words, what price would all other classes have to pay for granting this boon to miners? The rise in the price of coal would be out of proportion to the increased cost of production. This would be a serious thing for the families of the working classes; but the indirect effect upon the industries of the country would be far more serious.

Mr. WINSTON CHURCHILL said the Government could not be accused of acting precipitately in bringing this question before the House. It had been debated for thirty years, and the debate now concluding had thrown very little new light upon the subject. The admirable report of the Departmental Committee, which would command the approval of all parties in the House, did not pronounce a final judgment on the question, and therefore could not give entire satisfaction to any one. The Committee pointed out how the effects of the reduced hours of labour might be mitigated by improved methods of haulage, coal-cutting machinery, and other means, or by a system of working double or multiple shifts. As to this, he would only say that the system was already in vogue, and its extension would not present so great a difficulty as was sometimes supposed. Even if they assumed that there would be a net reduction in the output of coal, consequent upon the effect of the Bill—which he could not admit—this reduction must be temporary and transient in its character. For fifty years there had been continuous changes in coal mining in this country; and, though they were told that these changes would militate against production, the history of the coal trade had been one steady, unbroken expansion of output. This argument would be wholly vitiated if the restriction of hours proposed by the Bill were violent in character, sudden in application, or rigid in method. He could not bring himself to believe that, with all the safeguards and mitigations proposed, it would not be possible for the coal industry to accommodate itself to the new conditions. The reasons for the Bill were social. They believed that the well-being of the colliery population would be notably and sensibly advanced in respect of their health, industrial efficiency, their education and culture, and their general enjoyment of life, by the abatement of harsh conditions of labour. The general march of industrial democracy was not towards inadequate hours of work, but sufficient hours of leisure. This was the movement among working people all over the country. There were other factors pressing for consideration. What about mining royalties? Would the House believe that it was calculated that mining royalties imposed a toll of 6 per cent., calculated on the price of coal at the pit's mouth, or considerably more than half the total of the possible reduction which could result from this humane act of labour legislation? Then it was asked: Why not deal with other industries? Well, who said they would not? He welcomed and supported this measure, not only for its own sake, but much more because he believed it was the precursor of the general movement which was in progress all over the world towards the reconciling of the conditions of labour to the well-ascertained laws of science and health. Other labouring men would see that in the end their turn would come for shorter hours. Let the House vote for the second reading of the Bill, and in so doing establish a claim on the respect of Parliaments to come.

The House then divided on the amendment, which was lost by 390 votes to 120—a majority of 270. The second reading was then agreed to without a division.

Mr. BALFOUR then moved that the Bill be referred to a Committee of the Whole House; but, on a division, the motion was defeated by 391 votes to 113—a majority of 278.

BOGNOR GAS BILL.

The Unopposed Bills Committee of the House of Commons met last Tuesday—the Chairman of Committees (Mr. Alfred Emmott) presiding—for the purpose of considering the Bill promoted by the Bognor Gas Company with the object, among other things, of dissolving and reincorporating the Company, and converting the capital. This consists partly of 10 per cent. and partly of 7 per cent. stock; and by the Bill as originally brought before the Committee it was proposed to convert the two stocks into one uniform 5 per cent. stock. Exception was, however, taken to this by the Committee, on the ground that it would place the holders of 10 per cent. stock in a better position than they are at present. The promoters therefore discussed the matter with the Speaker's Counsel (Mr. Edward Moon, K.C.), with the result that the scheme was remodelled. Under the new scheme, two classes, "A" and "B," of consolidated stock will be created, both bearing interest at the rate of 5 per cent.; and such amounts of stock will be allotted that the position of the holders will be practically the same as formerly. The Company work under a sliding-scale, and this is adjusted in the Bill in accordance with the new capital arrangement. The Committee thought the amended scheme reasonable. Formal proof of the preamble having been tendered, the Bill was allowed to proceed.

PROCEDURE IN REGARD TO PROVISIONAL ORDERS.

In the "JOURNAL" last week (p. 29), attention was called to a Bill which was introduced into the House of Lords, by Lord Hamilton of Dalzell, on the 29th ult., and read the first time, to enable the Board of Trade to make rules as to the procedure for granting Provisional Orders. Last Tuesday, his Lordship moved the second reading of the Bill. He said the power of granting Provisional Orders had been exercised by the Department for a number of years. The first powers, which related to piers and harbours, dated from 1861; those dealing with tramways and the supply of gas and water from 1870; and those under the Supply of Electricity Act from 1882. The Bill did not enlarge the scope of these powers, but sought to remove certain difficulties which had arisen from the fact that the later Acts of Parliament laid down the exact procedure that was to be adopted. The Board sought power to change the date on which Draft Orders had to be registered, to systematize the length of notice required, and otherwise to remove various inconveniences. The rules that would be drawn up would have to be submitted to Parliament, where they could be amended, and would have statutory force. Lord Ashbourne did not offer any obstacle to the Bill, but thought it obvious that it made the Board of Trade supreme with regard to the important matters referred to it by Act of Parliament. He considered it was a serious thing to transfer these powers from Parliament, with all its facilities for examination, revision, and inquiry, to one of the Government Departments. However, he was sure the objects of the Bill were to simplify procedure and save expense. Lord Hamilton of Dalzell said he thought the noble and learned lord exaggerated the possible effects of the measure. The Bill was read a second time.

We learn from Mr. Arthur L. Griffith, the Secretary of the Society of British Gas Industries, that the Society has been considering the subject dealt with in the Bill, and that a memorial (copy of which he forwarded) was sent to the President of the Board of Trade on the 23rd ult. The Society has also been in communication with the Institution of Gas Engineers on the matter. The following is the memorial.

To the Right Hon. Winston S. Churchill, M.P.,
President of the Board of Trade.

The Memorial of the Society of British Gas Industries showeth as follows:—

1.—Your memorialists represent the chief manufacturing firms in the kingdom which make plant and accessories used by gas companies, and they have embarked in the aggregate a large amount of capital in equipping their works for this class of trade.

2.—They realize that the industries carried on by them suffer from the way in which lack of security deters the proprietors of non-statutory gas undertakings from developing their businesses.

3.—They also realize that lack of security is a very serious obstacle to the formation of small local companies and the construction of works to supply gas in many small towns and country villages in which the inhabitants at present depend upon imported oil for their light.

4.—During the 38 years which have gone by since the passing of the Gas [and Water] Works Facilities Act, only about 50 non-statutory gas undertakings have applied to the Board of Trade for statutory powers; and there are still about 850 gas-works being worked in the United Kingdom as non-statutory undertakings. If security were afforded to them, each of these 850 undertakings could profitably spend on useful developments an amount of capital that would, in the aggregate, reach a very large total, in addition to which there would be a permanent annual expenditure for maintenance.

5.—The expenditure which could be made if the insecurity were removed would increase the rateable values of the towns and villages affected, and make them much more attractive to live in.

6.—The uncertainty as to the result and the cost inseparable from an application for a Provisional Order deter undertakers from approaching the Board of Trade.

Your memorialists therefore pray that legislation may be promoted with the object of extending the powers of the Board of Trade in granting Orders, and of simplifying and cheapening procedure under the Gas [and Water] Works Facilities Act, which they feel would result in a great increase of home trade, and employment both to your memorialists and to the public in the localities where these facilities would be beneficial.

To the memorial was attached the following signatures: George Livesey, President; Chas. Clare, Fred. J. West, Jas. W. Wilson, Thos. S. Clapham, J. W. Broadhead, John Mackay, Thos. G. Marsh, H. M. Thornton, J. A. Drake, members of the Council; and Arthur L. Griffith, Secretary.

Seventeen candidates who have satisfactorily passed a practical examination in gas testing have been appointed by the London County Council to fill vacancies on the staff. The commencing salary is £135 a year, rising by annual increments of £5 to £165.

MISCELLANEOUS NEWS.

TRAINING LADS AS GAS-FITTERS.

The Gaslight and Coke Company's Scheme.

In connection with the report, in the last number of the "JOURNAL" (p. 53), of the Education Committee of the London County Council on the arrangement entered into with the Gaslight and Coke Company for the training of lads as gas-fitters, and the editorial remarks thereon, the following correspondence on the subject, which has been sent by Mr. D. Milne Watson, the Company's General Manager, will doubtless be read with interest.

The Gaslight and Coke Company,
Horseferry Road, Westminster, S.W., March 27, 1908.

Dear Sir,—Referring to our previous correspondence, the Directors of this Company are at present engaged in considering a scheme for the training and education of lads as gas-fitters, and I am writing to ask you to ascertain whether the London County Council would assist the Company in this matter by providing afternoon classes at one of their Technical Institutions—preferably the one in Vincent Square, which is quite near this office—on two or more afternoons in the week; the subjects which we would prefer should be dealt with being drawing, workshop arithmetic, composition, and *précis* writing. The Company propose to provide a workshop fitted with the plant and apparatus required for demonstration and practical work, and consider that a course of training extending over a period of two years should be sufficient. If the County Council are prepared to assist the Company in the training of these lads by the provision of the lectures above referred to, I should be glad to know whether they would be willing to recommend lads whom they consider suitable, and whether they would submit a list of candidates for the Company to choose from.

With regard to the number of lads the Company are prepared to deal with, they propose to limit them, as nearly as possible, to the number for whom they could afterwards reasonably expect to find regular employment. This number would probably not exceed, in the first instance, 24 per annum. The Company would not guarantee to provide the lads with permanent employment, and would reserve to themselves the right to discharge any lad they found unsatisfactory, and also the power to place any lad in the training-shop who had not come to them through the channel of the London County Council schools. They propose to open their workshop next autumn, and desire that the lads entering upon this course of instruction should not be less than fourteen years of age.

Should your Committee desire any further particulars with regard to the Company's scheme, I shall be very pleased to furnish them. I may add that the Company would probably pay the youths a small sum weekly during the period of training.

(Signed) D. MILNE WATSON, General Manager.

R. Blair, Esq.,
London County Council Education Department,
Victoria Embankment, W.C.

London County Council (Education Offices),
Victoria Embankment, W.C., July 2, 1908.

SIR,—The Council has had under consideration the scheme prepared by the Directors of the Gaslight and Coke Company for the training of lads to enter the service of the Company as gas-fitters, which was set out in your correspondence with the Executive Officer. The Council observes that the Directors desire it to recommend suitable boys for the two years' period of training in the Company's workshops, and to provide at the L.C.C. Westminster Technical Institute instruction for the boys in subjects complementary to those dealt with in the shops. The Council understands that the boys will receive as wages at least 2s. 6d. a week in the first year and 10s. a week in the second year of their training.

I am now directed to state that the Council is prepared to recommend 24 suitable boys, not less than fourteen years of age, for the two years' course of training, commencing in September, 1908, and to provide instruction for the boys in workshop arithmetic, mechanical drawing and sketching, English composition, and elementary mechanics (or physics and chemistry, if desired), on three afternoons a week, from 3 to 6 p.m., at the L.C.C. Westminster Technical Institute. The Council proposes, however, to make it a condition that the boys, after completing their two years' course, shall be required to attend a third year's course in specialized subjects in the evening classes provided by the Council at the Institute.

I am further to state that the Council agrees to the right of the Company to discharge from their service any lad whom they may find to be unsatisfactory, and to place any lad in the training workshop who has not been recommended to them by the Council. I am, however, to add that the Council wishes to reserve to itself the right to admit to the course of instruction to be provided at the L.C.C. Westminster Technical Institute, pupils other than employees of the Company.

I am also to express the appreciation of the Council of the action of the Company in this matter, which constitutes a very important departure in the direction of an association between employers and the Council's schools and technical institutes. The Council is of opinion that co-operation of this kind, between the larger employers of labour in London and the schools, would be of very great advantage to the boys, and would also conduce to the interests of the employers by raising the efficiency of the workers, while it would probably go far to prevent a large number of boys from sinking into the ranks of the unemployed.

(Signed) H. J. MORDAUNT, Assistant-Clerk of the Council.

D. Milne Watson, Esq.,
General Manager, Gaslight and Coke Company,
Horseferry Road, Westminster, S.W.

MANCHESTER GAS UNDERTAKING ACCOUNTS.

The Consumption Still Increasing.

We have received from Mr. Charles Nickson, the Superintendent of the City of Manchester Gas Department, the report and accounts of the Gas Committee for the year ending March 31; and from them the following particulars have been gathered. The report bears the signature of Alderman R. Gibson, the Chairman of the Committee.

The quantity of coal and cannel carbonized (including the equivalents of enriching materials) was 527,891 tons, compared with 503,693 tons in the previous year; the quantity of gas made per ton being 10,948 cubic feet, against 11,099 feet. The quantity of gas sent out from the works (5,777,516,000 cubic feet) shows an increase of 187,610,000 feet, or 3·36 per cent., as compared with an increase of 270,071,000 feet, or 5·08 per cent., the preceding year. The quantity of carburetted water gas produced during the year was 1,164,117,000 cubic feet, as compared with 1,191,215,000 cubic feet the previous year. In the production of this gas 2,709,355 gallons of oil and 23,990 tons of coke were used, as against 2,930,081 gallons and 24,526 tons respectively for the year ending March, 1907. The illuminating power of the gas sent from the works, as tested by the "Metropolitan" No. 2 burner, was 17·53 standard sperm candles. The unaccounted-for gas was 3·54 per cent., which compares with 3·14 per cent. for the previous year.

The number of consumers on March 31 was 170,938, of whom 22,286 were outside the city. The previous year the number was 166,061, of whom 21,017 were outside the city. The total increase was thus 4877. Of the total consumers, 56,368 use prepayment meters. This compares with 54,705 in the previous year—an increase of 1663; and of this increase 1238 have been fixed in the city and 425 in the out-townships. The quantity of gas passed by these meters was 518,068,000 feet, an increase of 43,486,000 feet, or 9·16 per cent., on the previous year. The meters have been inspected once in every five weeks; and the amount collected during the year was £72,737 6s. 11d. This is represented by 17,456,963 pennies, weighing 155 tons 17 cwt. 1 qr. 7 lbs. The number of gas-cookers owned and fixed by the Committee at March 31 was 41,456, compared with 36,214 for the year ending March, 1907. The total quantity of gas that was consumed by cookers is estimated at 570,000,000 cubic feet—being an increase of 66,000,000 feet, or 13·09 per cent., on last year's figures. There have also been fixed 29,706 grillers in connection with prepayment and small ordinary meters. About 41 per cent. of the consumers now have the free use of a cooker or griller. On March 31 last the number of gas-engines in use was 1741, as compared with 1732 in the previous year. The quantity of gas consumed by these engines was 426,130,000 cubic feet—an increase of 9,903,000 feet, or 2·38 per cent. The cost of coal, cannel, and oil per ton carbonized was 11s. 4·17d., as against 9s. 11·81d. for the previous year, an increase of 1s. 4·36d. per ton, which, on the total carbonization of 527,891 tons, amounts to £35,984.

The total income was £782,690, against £730,902, and the expenditure £618,702, against £564,304. The gross profit on the year's working was £163,987. The sum of £47,806 was paid for interest on loans, &c. The net profit therefore amounted to £116,181, as compared with £120,123 in the previous year. This sum, together with £7359 transferred from reserve—making together £123,540—has been appropriated as follows: To the sinking fund for redemptions of loans, £58,573; paid over to city fund, £50,000; extension of carburetted water-gas plant, £551; extension of the Whitworth Street West depôt, £286; general extensions (wages), £9025; purchase of consolidated 4 per cent. stock for cancellation, £5105.

During the year the re-building has been proceeded with of the second section of the No. 2 retort-house at the Gaythorn station to contain eighteen beds of inclined retorts of a capacity of 2¼ million cubic feet per day. The work completed includes the strengthening of the river wall, the covering of the river with steel girders and brick arches, the building of walls to support the roof, and the erection of the steel roof. No. 2 gasholder, which was erected forty years ago, has been re-sheeted. The work of re-constructing the Rochdale Road station, which has been in progress during the past five years, is practically complete. New stores adjacent to the general offices have been erected, and are now in use, resulting in much better control of this department of the works. Two washers for the extraction of naphthalene from the gas have been erected, and proved effective in reducing the number of stoppages of service-pipes in the district supplied from this station. During the year a commencement was made with the construction of the new gasholder tank at the Bradford Road station; and the work is making satisfactory progress. The railway gantry adjacent to the No. 2 retort-house has been renewed, and good progress has been made with the construction of the coal-bunker walls. The total length of mains now laid is 1,606,273 yards, or 912½ miles and 273 yards; being an increase of 14 miles and 372 yards during the year. The number of public lamps within the city is 18,478, and outside the city 2285—a total of 20,763, of which 17,459 within the city are fitted with 23,967 incandescent burners.

The following are the principal items in the accounts:—

REVENUE ACCOUNT.

INCOME.

Gas-rental—			
Ordinary meters			£507,577 3 6
Prepayment meters			72,737 6 11
Public lamps			41,375 18 9
Residual products—			
Coke	£97,721 11 8		
Tar	25,359 13 11		
Sulphate of ammonia	36,644 3 7		
Carbon	408 6 10		
			160,133 16 0
Rents of cottages, &c.			865 8 10
			£782,689 14 0

EXPENDITURE.

Manufacture—			
Cannel, coal, and oil (including cost of unloading, &c.)	£299,510 10 3		
Coke, water, &c. (carburetted water gas)	8,553 12 11		
Carbonization (wages)	47,617 15 5		
Purification (less sales of spent material, £5327 15s. 4d.)	1,055 17 4		
Retorts, fire-bricks, &c.	8,714 11 2		
Repairs and maintenance of works, &c.	43,949 8 2		
Salaries of Engineer and works staff (less proportion transferred, £1775 11s. 7d.)	6,187 13 0		
	£415,589 8 3		
Provision for renewal of works plant (less £1207 1s. 8d. charged to sulphate of ammonia)	19,734 0 0		
		£435,323 8 3	
Distribution—			
Repair and maintenance of mains, services, meters, and stoves	£32,826 7 6		
Salaries (less proportion transferred, £300)	25,436 19 9		
	£58,263 7 3		
Provision for renewal of distribution plant	44,365 0 0		
		102,628 7 3	
Rents, rates, and taxes		55,590 4 6	
Management—			
Salaries	£16,823 12 3		
General charges	5,431 11 6		
		22,255 3 9	
Law and parliamentary charges		136 2 7	
Subscriptions and donations		1,898 13 3	
Bad debts		869 18 0	
		£618,701 17 7	
Balance carried to profit and loss account		163,987 16 5	
		£782,689 14 0	

The accounts are followed by the usual appendices, furnishing particulars in regard to the progress of the undertaking.

Appendix A is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.		Twenty-four Hours. Cubic Feet.
Year ended March 31, 1908	1,901,857,000	..	5,777,516,000
Do. Do. 1907	1,779,779,000	..	5,589,906,000
Increase	122,078,000	..	187,610,000

	Cubic Feet.
Gas transmitted from the works	5,777,516,000
Do. accounted for	5,572,805,000
Loss (by condensation and leakage)	204,711,000

or 3·54 per cent.

In Appendix B, particulars are given as to the results of the working from March 31, 1889, to March 31, 1908. The table contains statistics as to the number of tons of coal and cannel carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 527,891 tons; gas made, 5,779,256,000 cubic feet; yield per ton of coal carbonized, 10,948 cubic feet; illuminating power, 17·53 candles; quantity sold, 5,446,283,000 cubic feet; quantity sold per ton, 10,317 cubic feet; percentage of output unaccounted for, 3·54; coke for sale, 217,996 tons; do. per ton of coal, 10·35 cwt.; make of tar, 28,420 tons; do. per ton of coal, 11·75 gallons; ammoniacal liquor (10-oz. strength) made, 11,615,608 gallons; do. per ton of coal, 27·57 gallons; sulphate made, 4429 tons; do. per ton of coal, 23·96 lbs.

Appendix C shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 35,076 stoves within, and 6380 beyond, the city—together 41,456, compared with 30,705 and 5509 (together, 36,214) at the corresponding date in 1907; so that there was an increase of 5242. The number of meters in use was 170,938 in 1908 and 166,061 in 1907. There was last year a net increase of 4877 on the number for the preceding year. The number of prepayment meters in use on March 31 last was 56,368—an increase of 1663 on the number at the close of the preceding year.

From Appendix D, we learn that the gas-mains laid last year within the city extended to 32,183 yards, and beyond the city to 9216 yards—being 23½ miles and 39 yards. The mains taken up were 13,501 and 2886 yards respectively—a total of 16,387 yards, or 9¼ miles and 107 yards. The total net increase during the year, therefore, was 25,012 yards, or 14 miles and 372 yards. The total length of mains at March was 1,606,273 yards, or 912½ miles and 273 yards.

Appendix E is an abstract of the capital, revenue, and profit and loss accounts. It shows (*inter alia*) the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from March 31, 1888, to March 31 last. The figures for the past financial year are as follows: Gross profit, £165,339; net profit, £116,181; contributed to sinking fund for redemption of debt, £58,572; paid over for improvement purposes and city fund, £50,000; applied in extension of works, £14,968; borrowed money owing, £1,216,039; and excess of assets, £1,617,218. From June 24, 1843, the date when the works were taken over by the Corporation from the Commissioners of Police, the gross profits on the gas undertaking have amounted to £5,918,948, out of which £1,415,104 has been paid for interest—leaving a net profit of £4,503,844. Of this total, £1,405,078 has been placed to the sinking fund, £2,529,383 has been handed over to the Improvement Committee and added to the city fund, £329,201 has been paid for street lighting (making £2,858,584 used in relief of the rates), and £198,402 applied to extensions of works.

TWENTY YEARS' GAS PROGRESS IN MILAN.

The City of Milan is the principal one of the dozen or more towns that are lighted by the Union des Gaz and Continental Union Gas Companies. The development, therefore, of its public services during the last twenty years is not without interest, as bearing upon the prosperity of these Companies. We learn from our contemporary "Il Gaz," that Signor Ing. F. Minori, who is attached to the Municipal Technical Office, has recently read a paper on the growth of the public services in the industrial capital of Italy; and from it we extract the following particulars relating to the gas-works and gas lighting.

In 1887, there were two gas-works in Milan—one at Porta Nuova, and the other at Porta Lodovica. In the year 1886-7, the quantity of coal carbonized was 56,940 tons; and the gas produced amounted to 16,849,800 cubic metres, of which 12,772,000 cubic metres were used by private consumers. Last year 213,638 tons of coal were carbonized, and 64,670,540 cubic metres of gas made. In 1886-7, there were 20,000 consumers out of 350,000 inhabitants, or one consumer to every 17; whereas to-day there are 110,232 consumers out of 560,000 inhabitants, or one out of every five. Needless to say, the plant at the works has had to be greatly extended. The works at Porta Lodovica (generally known as the San Celso works) have been enlarged so as to make 250,000 cubic metres, or nearly 9 million cubic feet, of gas per day. The Porta Nuova works can produce per 24 hours 40,000 cubic metres (say, 1½ million cubic feet) of gas; and those at Porta Venezia, which are small works, have a capacity of 8000 cubic metres (282,000 cubic feet) per day. Large new works have been recently built at Bovisa, which at present can produce 60,000 cubic metres (upwards of 2 million cubic feet) of gas, and are designed eventually for 500,000 cubic metres, or approaching 18 million cubic feet, per day. The last-named new works have the largest gasholder in Italy (though it is not a very large one compared with those in British works); it having a capacity of 80,000 cubic metres, or about 2,825,000 cubic feet.

These are the only figures given showing the gas development, and they compare very favourably with any statistics relating to electrical development. Several comparative figures in regard to communal life are given, all showing the great progress and commercial activity of the prosperous and ever-growing capital of Lombardy.

Tottenham and Edmonton Gas Company and Outside Lighting.

Last week's meeting of the Harringay Tradesmen's Association was attended by Mr. A. E. Broadberry, the Engineer and Manager of the Tottenham and Edmonton Gas Company, who submitted certain proposals with respect to the outside lighting of the shops in Green Lanes, one of the most important business thoroughfares in the district. He explained that if an arrangement could be made with the occupiers of the shops, the Company would provide and fix 64 Sugg's "Newark" high-pressure lamps on the existing arms, instal a compressing plant, supply the necessary gas and mantles for an average lighting throughout the year of 3 hours per night (varying according to the time of year and the night of the week), and attend to the cleaning of the lamps, for the quarterly charge of £1 per lamp. Mr. Broadberry said that it would be necessary to obtain the consent of the shopkeepers to do the necessary work; but he thought this would not present much difficulty. He declared that gas companies were never afraid to discuss electricity, or to meet it. When gas was properly attended to, it was impossible for the electric light to come near it. Mr. Broadberry was thanked for attending the meeting; and the matter was referred to a Committee for consideration.

Danger of Electric Motors.—Last Wednesday, there was a fire at St. Peter's Church, Eastbourne, the organ of which is worked by an electric motor. The outbreak originated near the main switch; and the motor and pneumatic tubes were destroyed, while the keyboard, which is some distance from the organ, shared the same fate. Some flooring was burned, and portions of the interior were scorched; but the damage to the organ was confined to the keyboard. It will be necessary, however, to cleanse the whole church before it can be used again for public worship.

Plymouth Gas-Workers' Annual Outing.—Last week the employees of the Plymouth and Stonehouse Gas Company and their friends had their annual excursion, which as usual proved a very enjoyable affair. As is customary, the Directors of the Company provided the funds; and the arrangements were made by Mr. P. S. Hoyte, the Manager. The party was divided into three; one section going on Tuesday, another on Wednesday, and the third on Thursday. This year they travelled by train to Totnes, thence by boat to Dartmouth, from which there was a long coach drive by the coast to Kingsbridge, and thence by train to Plymouth. Luncheon was provided at Dartmouth, and tea at Kingsbridge. Sir Joseph Bellamy, the Chairman of the Company, with Mr. T. Greek Wills, one of the Directors, and Mr. H. Heath, the Secretary, were among those who accompanied the first party; while Mr. Hoyte personally superintended the arrangements on all the days. In reply to the toast of "The Chairman and Directors" at the luncheon, Sir Joseph Bellamy said he was glad of the opportunity afforded by the gathering of expressing in a less formal way than at the annual meeting of shareholders the appreciation of the Directors of the goodwill which had during the year brought their efforts to a successful issue. The past twelve months had been a time of anxiety; but they had come out all right. The dividends might be a little less; but they could not control the price of coal. A new departure was to be made in the manufacture of "Coalite," which would have the effect of increasing the number of employees.

NOTTINGHAM CORPORATION GAS UNDERTAKING.

Projected Concentration of Operations.

An important proposal has been brought under the notice of the Nottingham Corporation for securing the greater efficiency of the working arrangements in connection with the gas undertaking. At present, Basford forms the centre of the main manufacturing and distributing plant; but there are two important district stations, at Eastcroft and Radford, entailing an expenditure which helps largely to augment the yearly total outlay for maintenance. A concentration of operations upon a larger area is deemed desirable, in the interests alike of economy and efficiency. Recently a large estate, known as Bulwell Hall, was acquired by Mr. Albert Ball, who is Chairman of the Gas Committee of the Corporation. The purchase was effected from the Trustees of the late Mr. Thomas Hardy by Mr. Ball, acting in his private and professional capacity as an estate agent. The site, which, by reason of its extent and convenience of situation, is looked upon as eminently suitable for the purpose, has since been offered by Mr. Ball to the Corporation as a centre for a main gas manufacturing and distributing station for the major portion of the city. The whole estate has an area of 574 acres; and its contiguity to the Great Central and other railways, as well as its proximity to the rich coalfield in the Leen Valley of Nottinghamshire, are features which have commended the offer to the favourable consideration of the Council. The purchase for £34,000 has been decided upon, and a deposit paid previous to the completion of the contract; Mr. Ball having agreed to sell the property, in the interest of the city, for the price which he paid for it.

DEVONPORT GAS-WORKS.

The Rebuilding of the Retort-House.

A large number of members of the Devonport Corporation and officials assembled at the gas-works on Tuesday last, when the foundation stone of the new retort-house was laid by Alderman W. Hornbrook, the Chairman of the Gas Committee. The new house, which includes the site of the present main retort-house, will be 280 ft. 9 in. long, 70 ft. 6 in. wide, and have a height of 27 feet to the eaves and of 50 feet to the apex of the roof. It is being built of limestone in a pleasing and substantial manner. The roof is being constructed of 16 semi-circular steel lattice girders, which commence 6 feet above the floor line and have their lowest point overhead at a height of 40 feet; so that there will be ample space for any system of retorts which it may be decided to erect. The roof is braced together with 150 lattice girders, and covered with slates; while the ventilators will be of the open type. In the designing of the retort-house, provision is made for coal-stores at each end, with a total capacity of nearly 4000 tons. The Contractors are Messrs. Willey and Co., of Exeter; and the builder, Mr. A. Andrews, of Devonport.

The Mayor (Mr. R. Smerdon), in calling upon Alderman Hornbrook to lay the foundation stone, said the gas-works was one of the most successful undertakings under the control of the Corporation. Up-to-date plant and machinery were, however, needed to meet modern requirements; and improvements and extensions were being gradually carried out. They were fortunate in having the services of a far-seeing and practical Engineer, under whose management and guidance a great change had been effected at the works; while the Chairman of the Committee had taken great interest in the undertaking, and had spared neither time nor pains to bring about its success.

Mr. Andrews then presented a silver trowel to Mr. Hornbrook, and said that in the construction of the building they had gone down to solid rock, so that they had no reason to fear such settlements as had led to the cracks in the original buildings.

Alderman Hornbrook, after laying the stone, said that in about two months they hoped to be able to invite the Mayor to open the new building. There had been days of anxiety and trouble in connection with these works; but those days had passed away, and everything now seemed bright. A month ago it was his pleasure and privilege to place before the town a statement as to the financial position of the undertaking; and no town ever heard a more cheery one. In a very short time between £40,000 and £50,000 had been absolutely saved, besides which several thousand pounds worth of work had been done out of the ordinary revenue. Within comparatively few years every penny of the debt on the undertaking would be paid; and then the gas consumer, and not the ordinary ratepayer, would have the advantage—at least, he hoped so, for that was the right and proper and just policy. They were grateful to their Engineer; and they hoped he would be spared to them at least until the completion of the reconstruction of the works. They were not going to keep Mr. Buckley always; for Devonport was not large enough for a man of his ability. As to the immediate work in hand, he had been criticized for describing the buildings as rotten; but it would be seen, from what remained of the old retort-house, that this was literally a true description, and that the place was positively dangerous for the men to work in. When the buildings were completed and new retorts and machinery installed, they would be in a position to save 6d. or 7d. per 1000 cubic feet in the cost of making gas. Unfortunately, they began at the wrong end in the reconstruction of the works. It should have been done years ago.

Alderman Paul, in moving a vote of thanks to the Mayor for his presence, said that if the retort-house had been rebuilt a few years ago it would have been the means of saving the town £40,000. Although they had had to face the decrease of consumption of gas in the Government establishments and other large places, they were, thanks to the introduction of slot-meters, in a far better position, and their income was much greater, than when they were supplying the Government.

The Mayor, in acknowledging the compliment, said it was very gratifying to find the undertaking prospering under circumstances which looked so unfavourable at one time.

Alderman Hornbrook acknowledged the services of the officials, and said that the only fault he had to find with the Engineer was that he would take the bit between his teeth and go whether they wanted him to do so or not. Mr. Buckley was so constituted that he could not rest quietly while anything of an irregular nature prevailed.

Mr. Buckley, in reply, said that one of the things which induced him to come to Devonport was the knowledge that the works required a strong Engineer. The building they were now engaged upon should have been begun in the very first year that the Corporation took possession of the gas undertaking. They were doing it now because it was absolutely necessary. If they travelled the country through, they would not find a retort-house in such a deplorable and shocking condition. It was a fact that the effects of rain had been more apparent in the retort-house than in the open yard, and that, owing to the dilapidated condition of the roof, it was dangerous to work there. When the new retort-house was finished, it would be one of the finest in the country, and would be capable of producing 100 per cent. more gas than at present. They had, however, still to face a large expenditure on machinery; and in this connection he regretted that he was unable to visit Berlin with the members of the Institution of Gas Engineers, and to see there what was recognized as the best system of carbonization. Since the Corporation acquired the works, the sales of gas had increased 50 per cent.; the installation of 8000 or 9000 slot-meters having counteracted to a marvellous extent the falling off in the consumption of gas in the Dockyard and the competition of the Municipal electric light works. It ought to be understood that it was the consuming ratepayers who were the backbone of the gas undertaking. The non-consumers had no interest in it. But for the consumers, the works would be only a scrap-heap; and it should be remembered that, whether they were worked or not, an enormous sum had to be provided every year to pay the interest and sinking fund. It was, therefore, necessary to see that every possible means was adopted to increase the sale of gas; and in modern gas-cookers and slot-meters they had two excellent strings to their bow.

The Town Clerk (Mr. R. J. Fittall) said that when they were told that they bought an old and worn out concern it must be remembered that they paid a corresponding price for it. They did not pay for an up-to-date works; and this was so far realized at the time that they included in the Act authorizing the purchase borrowing powers for £100,000. There had been many difficulties to face; but there was nothing of a contentious nature now left. There were few towns of similar size in which the price of gas was lower than in Devonport. They had the increased cost of coal and obsolete works to contend with. It was true that a municipality could not work a gas undertaking on the same lines as a company. They had to pay heavy charges for interest and sinking fund; but the effect of this was that in a few years their capital was paid off, whereas a company kept the whole of its capital floating.

Councillor Cousins expressed the opinion that the original error was made in placing themselves in the hands of experts in London. The late Engineer begged them to do something to the retort-house, so that he could make gas.

A SATISFACTORY YEAR AT ASHFORD.

At the last Meeting of the Ashford Urban District Council, Mr. Herbert R. Turner, the Engineer and Manager, presented his report on the working of the gas undertaking for the twelve months ended March 31, which was his first complete year of management there. The adoption of the report and balance-sheet was accompanied by considerable satisfaction, particularly as the results have surpassed any previously obtained; the working expenses per 1000 cubic feet of gas sold being the lowest on record, and the gross profits the highest.

The total receipts amounted to £15,757, and the expenditure on the revenue account to £10,058, leaving a gross profit of £5699—notwithstanding that coal cost £650 more than in the previous year, and the extra price charged for gas to the ordinary consumers only realized a sum of £250, while the revenue account was debited with the depreciation of plant caused by the demolition of old settings to make room for the new carburetted water-gas plant recently erected. After providing £4511 for instalments and interest on loans, a net profit was left of £1188, to be applied to the rates. The capital expenditure during the year for new coal-gas and carburetted water-gas generating plant, extensions to boilers, new engine-room, &c., was £3030, which Mr. Turner anticipates will be sufficient to meet all the requirements for the next six years at least.

The demand for gas showed a steady increase, to meet which 73,150,000 cubic feet was manufactured—equal to an increase of 4·4 per cent. This was made up of 66,713,000 cubic feet of coal gas, and 6,437,000 cubic feet of carburetted water gas since the completion of the plant last autumn. An average make per ton of 10,446 cubic feet was maintained; and the improved carbonizing results show a saving of 700 tons of coal, of a net value of £437. These figures, together with the water gas, have reduced the cost of carbonizing wages ½d. per 1000 cubic feet, though the stokers' wages were higher than in the previous year—in other words, an additional 3,138,000 cubic feet were produced, at a cost for wages only of £101 less than in the previous year. The working statement shows the total working expenses per 1000 cubic feet sold to have been 11·35d., against 13·94d. in the preceding year; while the net profit rose from 16·46d. to 20·88d. per 1000 cubic feet.

With regard to residuals, the fuel used on the works was considerably reduced; and, as a consequence, 8 per cent. more coke per ton of coal carbonized was available for sale. Tar also showed an increased yield of 1·8 gallons per ton; and the sulphate of ammonia was manufactured at 4s. 7d. per ton less than in the previous year. During the twelve months, 84 new meters were fixed, making the total number now in use 2264; while 1057 stoves are out on hire.

The Chairman, in expressing his satisfaction, remarked that the results fully justified, not only Mr. Turner's appointment, but the £70 rise in salary which the Council granted him last year.

Permission has been given by the Local Government Board to the Teignmouth Urban District Council to borrow £1000 for the provision of gas meters and stoves.

DARLINGTON CORPORATION GAS SUPPLY.

The Past Year's Working—Gas Engineer's Salary Increased.

We have received from the Engineer and Manager of the Darlington Corporation Gas-Works (Mr. Frank P. Tarratt) the accounts and statistics of the undertaking for the year ending the 31st of March. The revenue from the sale of gas amounted to £35,131; residuals produced £16,275; meter and stove rents came to £1780; and the total receipts were £53,523. The expenditure on the manufacture of gas was £30,101; on distribution, £5169; and on management, £2139—the total expenses being £39,858. There was consequently a balance of £13,665 to be transferred to the profit and loss account, the total of which at the close of the financial year was £19,990. This sum was drawn upon as follows: Liquidation of loans, £4069; interest on loans, £3167; transferred to district fund account in aid of rates, £4000; and transferred to reserve account, £2325—leaving £6429 to be carried to the balance-sheet. The working statement shows that the gross cost of gas—£39,858—was at the rate of 21s. 8·724d. per ton of coal carbonized and 2s. 4·523d. per 1000 feet of gas sold; the figures for the net cost being £21,466, 11s. 8·417d., and 1s. 3·362d. The net profit—£6429—was at the rate of 3s. 6·053d. per ton and 4·6d. per 1000 cubic feet of gas sold. The quantity of coal carbonized was 36,690 tons, and of gas made 368,112,000 cubic feet, or at the rate of 10,033 cubic feet per ton, of which 335,363,143 cubic feet, or 91·1 per cent., were sold. The tar produced was 10·41 gallons, and the liquor 24·59 gallons, per ton of coal. The average receipts per ton for coke and breeze were 13s. 5d.; for tar, 18s.; and for ammoniacal liquor, 10s. 5d. The capital works out to £5 1s. 1d. per ton of coal, and 11s. 1d. per 1000 cubic feet of gas sold. The gross profit is 7·367 per cent. on the capital employed.

At the meeting of the Town Council on the 1st inst., the General Purposes Committee recommended that the salary of the Gas Engineer and Manager be increased by £100 as from the 1st of April last, and by two further increments of £50 on the corresponding dates in 1909 and 1910. The Mayor (Mr. C. W. Starmer) having moved the adoption of the recommendation, Mr. Crooks moved, as an amendment, that the minute should be deleted, and expressed the opinion that the Engineer was not badly paid with his present remuneration. Mr. Robinson seconded the amendment, and said he hoped that the Council would not agree to the advance until the views of the ratepayers had been ascertained. He knew there was a strong feeling in the town against the proposal. Alderman Barron pointed out that when this subject was before the Committee, neither the mover nor the seconder of the amendment advanced a single argument against the increase in salary. Mr. Tarratt was entitled to reasonable remuneration for his services; and he (Alderman Barron) had sufficient confidence in the good sense of the members of the Council to leave the matter in their hands. In the result, only two votes were given in favour of the amendment, which was therefore lost. A further amendment to refer the minute back was also defeated; and the recommendation was agreed to. A public meeting, called by the Trades Council, was held in the Market Place last Thursday for the purpose of protesting against the decision of the Council, and a resolution to this effect was passed, as was another calling upon the Mayor to convene a town's meeting on the subject.

GAS MATTERS AT BURTON-UPON-TRENT.

Vertical Retorts—Reduction in Price—Coal Contracts.

At their Monthly Meeting last Wednesday, the Burton-upon-Trent Town Council had before them several matters of interest in connection with the gas undertaking.

Alderman Lowe, the Chairman of the Gas Committee, in moving the adoption of his Committee's report, referred to the proposal to send a small deputation of the members of the Committee to Germany, to ascertain whether the vertical retorts for which so much had been claimed were the success they were represented to be. It was suggested that they should send these gentlemen at the expense of the ratepayers; and there was a little feeling in the town, while there had been a certain amount of criticism. One gentleman had described the visit as a holiday jaunt; but let them look into the programme of the journey, and see how much it resembled a "holiday jaunt." After travelling for two days, they would visit Berlin and Cologne, and inspect the retorts there, and then return to Burton. They were about to reconstruct their gas-works, and to carry out a scheme which, as proposed, would involve the expenditure of £20,000 to £30,000. He would put it to them this way: Was there a single member of the Council who, having decided to spend a considerable sum of his own money, would not take the best possible steps to satisfy himself that any reconstruction which he would be undertaking would prove a success, whether he had to go to Germany or to the United States? Speaking for himself, he would be glad to be relieved of his selection as one of the deputation, because it meant giving up time which he could ill-afford to spare. He then read a letter from Mr. J. Ferguson Bell, the Council's Consulting Engineer, in the course of which he stated that he had recently been to Germany twice, and had found it, instead of a holiday, real hard work. He was much impressed with the results obtained at Berlin and Cologne, where vertical retorts were in operation. The members of the Sub-Committee did not pretend to be expert gas makers; but they were business men with some knowledge of the business, and they would be able to form an opinion of the system and ascertain for themselves the actual results. It appeared to him that if there was one town in England where vertical retorts were specially applicable it was Burton, because there was no doubt the coke produced by carbonizing coal in vertical retorts was superior to that obtained in horizontals, especially for malting purposes; and the Gas Department should, if possible, make a coke especially suitable for the requirements of the trade of the town. Mr. Bell further said that from the investigations he had made in Germany of vertical retorts in operation, there appeared no doubt the yield of ammonia was considerably increased. In conclusion, he expressed a strong opinion that three or four towns in Germany where vertical retorts were working should be visited before they committed the town to a new scheme.

Mr. Hutchinson (after the motion had been formally seconded) said that, after the description of Alderman Lowe of the deputation's proposed trip, he thought they would need a vote of condolence rather than opposition to their going. He did not quite agree with Alderman Lowe that whenever a deputation was projected the ratepayers objected. That was not quite so; but when a deputation was to leave the country, the outcry was natural, and he did not think the advantage gained by it would be commensurate with its cost. He should have thought that the sending of (say) Mr. R. S. Ramsden, the Manager, and Alderman Lowe would have been quite sufficient. If Mr. Bell was prepared to say that the retorts were good things, then the Chairman's and Mr. Ramsden's opinion would be sufficient. Mr. Bell did not say they were to send five people, but that it was desirable a deputation should go. He (the speaker) objected to the deputation, not on account of the *personnel*, but of its size. It might seem a small thing to spend £100 on a deputation when they were going to spend £20,000 or £30,000; but if it could be avoided, it should be.

Mr. Wardle supported Councillor Hutchinson, saying that unfortunately he was away when the selection was made. Though he was chosen, he did not feel anxious to serve. He felt that Mr. Bell was perfectly qualified to express an opinion; and he also thought it was necessary that the Chairman should go. There was no doubt that they should reconstruct their works, for the present retorts were all villainously bad. At the Derby Gas-Works there was a process altogether superior to their own; and in bringing the Burton works up to date, it was very necessary that they should make the fullest inquiry as to the proposed new method.

Mr. Austin said he could scarcely understand the desire to send such a deputation, who had no real knowledge of gas making. If the process was in the experimental stage and untried in England, Burton was not in a position to bear the expense of making a superficial inspection. If, however, it had been pronounced a success, then they had a right to benefit by the views of their own Engineer. There seemed to be a desire to shift the responsibility on to the shoulders of an amateur Committee; but it was hardly likely that they would be prepared to take the opinions of a Committee against expert advice. He should be unworthy of the confidence of the people if he did not raise his voice against the deputation; and he moved that the clause be referred back to the Committee.

Mr. Stack pointed out that Mr. Bell's advice was absolutely definite that they should go and see for themselves.

Mr. Gibson, in seconding the amendment, asked what the cost of the proposed trip would be; adding that he had always understood the gas-works were in splendid condition. Mr. Bell was an expert, and he should have thought that his opinion was sufficient. Could they not also write to Germany for the information needed; for if the system was working well there, it was positive proof that it would succeed in Burton? If the trip were taken, they would set a precedent for other Committees; and they would have trips *ad lib.* In any case, the trip ought not to be taken at the cost of the ratepayers; for they should not spend money in gallivanting off to Germany.

Mr. King, quoting Mr. Haldane that an ideal public man should possess the patience of Job, the temper of a saint, and the skin of a rhinoceros, suggested that this seemed to be necessary in the present instance, in order to face those who were not acquainted with the facts of the case. The argument against the deputation was that they should take Mr. Bell's advice, and that was to send to Germany and see for themselves. With all respect to the previous speakers, he dissented from their remarks running down the business men of the Committee, who were equally as capable in such matters as many directors of public companies. Three or four members of the Committee would enable the Council to have confidence in their recommendations. As a matter of fact, the Southport Gas Committee were about to proceed on the same errand. This was a work that would last a lifetime, and it was a matter of the utmost importance that they should get the most up-to-date works; so that the expenditure of £40 or £50 in such a case was very wise. Moreover, the Committee were unanimous.

Alderman Rowland said he was in hearty agreement with Mr. King's speech. They had heard a good deal during the afternoon about putting their trust in experts; but the fact of the matter was that experts generally differed on matters of this description. Whereas one was a violent upholder of a particular system, there was frequently another just as violent an opponent of it. He considered that, in addition to experts, the members of the Committee of such an undertaking as the gas-works should exercise their own business common-sense, and should be enabled to get a little knowledge first hand as to what they were going to recommend to the Council, and to the town, as well as follow the opinion of an expert. As an instance of it not being always desirable to rely solely upon expert advice, he would remind the Council that in connection with the reconstruction of retorts a report was given, in which the Committee were advised to adopt a certain type of retort; but it had since been discovered by the expert (one of the ablest in the country) that such retorts had not worked so successfully in the country as was contemplated when they were first recommended. This proved that they were not always going to be on sound lines by merely following the opinion of an expert. They had been told that in the gas-works they already had a good institution; but to his mind there was no reason why they should not have a better, and no reason why they should not endeavour to bring the concern up-to-date. The Committee for the past two or three years had had this end in view. Reference had been made to the expense to the ratepayers; but he considered that in managing a public undertaking like the gas-works they should do so on the same lines as a well-managed private concern. They could not ask any member of the Committee to go on such a mission as that and pay his own expenses. He must say that Mr. Austin's speech had surprised him; but Mr. King had sufficiently replied to the remarks relative to the amateur knowledge of the members of the Committee. He could himself, however, refer to collieries in the district which had directors who understood no more about colliery engineering than the members of the Gas Committee did about gas engineering; and yet they did not ever hear them criticized.

Alderman THOMPSON supported the recommendation of the Committee, because he was strongly of the opinion that only by going about and seeing what other people were doing would they be able to acquire information for themselves. He did feel that they did not want to rely wholly on experts. In his own particular department, he knew how frequently experts differed; but he felt that by encouraging enterprise of this kind they were educating more than one member of the Committee, and it was not wise that the Chairman should be the only member possessed of such information. In the interests of the town, they should encourage the Committee to do the best they could for the benefit of the undertaking of which they had charge.

Mr. THORNLEY, in supporting the amendment, said he did so, not with the idea that a deputation should not go to look at what they contemplated purchasing, but because of the size of the deputation. He was of opinion that it should be only half the size. Apparently these German retorts were something likely to create a stir at first; but they might be told in a few years time that they were not quite fulfilling what they were expected to do to-day. It seemed to him the retorts recommended had not found at least universal favour in their own country; and if they sent a deputation half the size to look at things made in Germany, they would be acting just as courteously to Germany as if they all went. If they sent a smaller deputation, and let them stay long enough to see the retorts at work several days, they would obtain better knowledge of what these retorts were doing than if a larger deputation paid simply a flying visit. They would not be leaving the door open for people to talk about amateur knowledge, &c. If they only spent two or three hours there, and had no one to explain anything except the German people, what would they learn during that short time? He thought the deputation was too large, and required reconsideration on the part of the Committee.

Alderman LOWE said it seemed as though some members of the Council imagined that the Wetmore Road works were up-to-date, and that they did not obtain the best results because they were amateurs. Really this was not the case; for their retorts were of a most old-fashioned pattern. They had almost made up their minds to have some similar to those at Derby, when the question of the vertical retorts came rapidly to the front on account of the good qualities claimed. He agreed that they in Burton could not afford to make experiments; but they were not going to rush matters. Still, though they were going to take their time, they must get their information and facts together. With regard to the suggestion that he and Mr. Ramsden should go, he thought it was unfair to ask one man to take the responsibility upon his shoulders. The Council might be sure they would not adopt these retorts without satisfying themselves that the results were at least, in some proportion, equal to those claimed for them.

The amendment was then put and lost, as was a subsequent one to limit the deputation to three persons.

The report was then carried.

Alderman LOWE, later on, in accordance with notice, moved a resolution to reduce the price of gas. He said that prices had been maintained at the same level for a long time in order to consolidate the financial position of the department. They had been adding to their depreciation fund during the past few years by sums varying from £3000 to £7000; and it was now neither necessary nor desirable to do more in this direction. It was therefore thought that the opportunity presented itself when they could deduct something from the price of gas, and thus benefit the consumers. The sum they proposed to take off was 3d. per 1000 cubic feet all round. This would mean a loss to the finances of about £3800 a year; but as the alteration did not come into force until June 30, the loss this year would be about £3000. They would be able to meet the loss, and also to pay their contribution of £6500 towards the relief of the rates. He thought they would agree with him that the Committee were quite justified in recommending the reduction. Their customers had waited very patiently; and they fully deserved the reduced price, which would, he knew, be thoroughly appreciated. It was, however, important to point out that the reduction did not affect gas for power, but was for lighting purposes. It would, of course, benefit the slot consumers; and whereas they now had 23 feet for 1d., they would in future get 25 feet. Certain mechanical alterations to the slot meters were necessary; and as there were 5000 of these in existence in the town, it would be well for consumers to understand that some little time must elapse before the alteration in all the meters could be effected.

The resolution was unanimously agreed to.

Alderman LOWE congratulated the Council on a saving of about 10d. per ton on coal—buying practically the same sorts—in connection with the new contracts for the gas-works, but called attention to the fact that, while the price of coal receded, the revenue from residuals also fell.

The Daylight Saving Bill.—In the House of Commons last Wednesday, Mr. Dundas White asked the Prime Minister whether the Government would give facilities for the passing this session of the Daylight Saving Bill, now entitled the Local Time (Great Britain and Ireland) Bill; and, if so, whether the Government would propose amendments making clear that the adoption of the proposed modification of time was not compulsory, and substituting for the words "local time" some less ambiguous term. Mr. Asquith said the Government had no intention of giving facilities for the passing of the Bill.

Malta and Mediterranean Gas Company, Limited.—An extraordinary general meeting of this Company was held last Tuesday, at the offices, Gracechurch Street, E.C., when confirmation was given to the resolution passed at the meeting on the 16th ult., as reported in the "JOURNAL" for the 23rd, cancelling No. 72 of the Company's Articles of Association, by which the Directors' remuneration was fixed at an annual sum of £500, with an additional £100 for each 1 per cent. of dividend declared above 6 per cent., and substituting for it a new article providing that the remuneration of the Board "shall consist of such an annual sum as the shareholders may determine at any meeting, in the convening of which notice shall have been given of the intended submission of any resolution with respect to the said remuneration." It was also unanimously agreed that the Directors should be paid annually £1000 by way of remuneration.

STAFFORD TOWN COUNCIL AND THEIR GAS MANAGER.

Last Tuesday, the Stafford Town Council spent a long time discussing a recommendation by the Gas Committee that a bonus of £100 should be given to Mr. Hubert Pooley, the Manager of the Gas and Electricity Works, "in recognition of services rendered during the last financial year, when the gas-works reached a higher degree of success than at any period of their history." On the proposal becoming known in the town, a public meeting was called, at which a resolution was passed protesting against the bonus, and urging the Council to reject the recommendation of the Committee. This the Council did, by the narrow majority of 16 votes to 13. Mr. C. H. Wright, the Chairman of the Committee, pointed out to the Council the advantage the town had derived from the skilful management of Mr. Pooley, who had not had an increase in salary for several years, and added that the Committee were still unanimous (in spite of the public meeting) in their desire that the bonus should be granted. Mr. Deakin remarked that he had nothing to say against the bonus being paid to the men at the works, because it was a profit-sharing scheme; but in regard to the Manager, he would much prefer a rise in salary. He did not think people would object to such an increase, after there had been a reduction in the price of gas. Mr. Wright replied that the Committee had decided on a bonus just because it was a thing of the moment, and not permanent. The argument of the opposition appeared to be that Mr. Pooley, with a salary of £450 a year, was adequately remunerated for the services he rendered, though Mr. Wright gave the meeting ample proof of the success of his management.

TYLDESLEY-WITH-SHAKERLEY GAS & WATER SUPPLY.

According to the annual report of the Gas and Water Engineer and Manager to the Urban District Council of Tyldesley-with-Shakerley (Mr. H. R. S. Williams), the gross profit of the Gas Department for the year ending March 31 was £3096. After deducting £2337, the amount paid for interest and sinking fund charges, there was a net profit of £759, which has been carried to the reserve fund, which now amounts to £1025. The gross profit was at the rate of 12·43 per cent. on the capital employed. The works and mains were maintained in an efficient condition as far as possible, taking into consideration the damage constantly being done by subsidence. There were 41,773,000 cubic feet of gas accounted for; being an increase of 1,491,000 cubic feet over the previous year, though the extra gas made was only 723 000 cubic feet—a result which is explained by the small quantity (5·19 per cent.) of gas unaccounted for. Seeing that building operations in the town are almost at a standstill, Mr. Williams points out that any increase in consumption must come through the present consumers utilizing gas to a greater extent. The Council can hardly hope to have a large demand for gas-fires in the locality, so they must look to cookers as the means of augmenting their sales. The total number fixed at the end of the year was 275; the average consumption per cooker was 6320 cubic feet per annum. The quantity of coal carbonized was 4069 tons, and of gas made 44,057,000 cubic feet, or at the rate of 10,826 cubic feet per ton, against 10,748 cubic feet in the year 1906 7. The coke made per ton of coal was 13·5 cwt., of which 9·63 cwt. was for sale; tar, 12·08 gallons; ammoniacal liquor, 24·69 gallons. The accounts of the Water Department for the year show a gross profit of £1164, which is at the rate of 23·1 per cent. on the capital employed. This sum is disposed of as follows: Sinking fund and interest, £345; contribution to rates, £500; net profit (carried forward), £319. The reserve fund now amounts to £697. The total quantity of water paid for to Manchester during the year was 190,246,000 gallons—an increase of 6,293,000 gallons over the previous year.

REDUCTION IN PRICE AT NEWCASTLE (STAFFS.).

At the last Meeting of the Newcastle (Staffs.) Town Council, there was adopted the annual report of Mr. J. C. Bladen, the Auditor of the gas-works, as well as a report of the Gas Committee recommending a reduction in the price of gas of 4d. per 1000 cubic feet.

In his report, Mr. Bladen said that the revenue account for the year to March 31 showed a gross profit of £7999—or deducting law and parliamentary charges in connection with the Wolstanton award (£338), £7661. After charging interest, and providing for the year's sinking fund instalments on the old and new stock, the net profit for the year was £3404, as compared with £2116 for the preceding year. The sum of £1700 had been handed over in relief of the rates. The loss (£296) on the Electric Light Department had also been paid by the gas undertaking; and the balance of profit and loss account carried forward was £11,146—being an increase for the year of £1409.

Mr. S. Myott, the Vice-Chairman of the Gas Committee, said that the capital account on March 31, 1907, was £105,093. During the past year new mains and service pipes had been put in at a cost of £191; making the total £105,284. There had, however, to be deducted an extraordinary repayment of £6580 by the Wolstanton Urban District Council, in respect of appliances which had been taken over from the Corporation in the Wolstanton area, thus leaving the capital account at £98,704. The expenditure on the revenue account during the past year had been £12,874, which included an extraordinary expenditure of £338 in respect of law and parliamentary charges. The gross income for the year was £20,535. The sale of gas brought in £15,875, and residuals £4660. The increase in the expenditure during the past year had been mainly due to the higher price of coal, which had gone up by about 30 per cent., representing something like an additional £1282. Against this the Committee had had an increase of £881 in the sale of gas, and an increase of £687 in that of residuals. The gross profit on the year was £7999, or, less law and parliamentary charges, £7661.

In 1907, the gross profit was £7460, or less law costs, £6572. The net profit last year, apart from sinking fund and interest, which amounted to £4256, was £3404. The gas made was 126,947,000 cubic feet, an increase of 8·7 per cent. upon the previous year. There was a leakage of 5·8 per cent. The Committee had paid £1700 to the Council in relief of the district rate; but they considered that gas consumers were the people who ought to reap any further benefit. There was a loss of £295 on the electricity undertaking; and this had been provided out of the profits of the gas-works (£1700), leaving the balance of profit for the past year £1409. The balance on the profit and loss account had previously stood at £9737, and with the £1409 now brought forward, there was a balance of £11,146. The Committee had decided —though they would lose a sale of gas amounting to nearly 20 million cubic feet during the ensuing year, owing to the Wolstanton area not now being lighted by the Corporation—to reduce the price of gas by 4d. per 1000 cubic feet, the reduction to take effect in the September quarter. He thought this would lead to an increased consumption in Newcastle. The Committee had just had a gas exhibition, with satisfactory results; and when the people of Newcastle found out that the Committee placed such facilities at their disposal, they would not be slow to take advantage of them. The demand for gas stoves and cookers was increasing very rapidly. The gas made per ton of coal carbonized was 11,730 cubic feet, and the quantity sold 11,040 feet. These were the best results the works had produced since they were taken over by the Corporation. The Committee had reduced the price of gas supplied to the sewage works from 2s. 6d. to 1s. 9d. per 1000 feet, which would mean a difference of about £75, and it had also been decided to lower the price of gas supplied to the Electricity Department from 2s. 3d. to 1s. 9d. per 1000 feet.

ALLEGED GAS POISONING IN GLASGOW.

A Curious Provision of Scotch Law.

In the Court of Session, Edinburgh, last Friday, Lord Guthrie had before him an action at the instance of Edward M'Andrew, his wife, and his mother, against the Glasgow Corporation as owners of the city gas undertaking. The first two pursuers sued for £250 each, and the last for £500, as damages for alleged poisoning by gas. They stated that they were occupants of a house and shop at No. 12, Carbeth Street. Gas was not used in any of the premises at that address; but a cast-iron gas-main belonging to the defenders is laid in the street about 6 feet from the front of the tenement. The place was at one time a free coup or toom, in which all kinds of refuse had been emptied, which contained chemicals or ashes which very rapidly corrode iron. Such ground, too, is liable to settle. This main, it was asserted, was very much corroded. It was also faultily laid, in respect that it was not supported by a cement bed or pillars. On Dec. 28, 1906, the main was leaking; and the gas from it percolated through the soil and penetrated the building. In consequence of this, the whole of the family suffered from poisoning, and a sister of the principal pursuers, aged 19, died. Five valuable prize canaries were also killed. The condition of the pipe was, it was said, known to the defenders, or ought to have been. It was further stated that it was the custom, in laying pipes in soil in which it was anticipated there were chemicals, to enclose them in a wooden case, into which tar or some other composition was run. This was not done; and, in addition, the defenders failed in their duty to inspect the main from time to time.

The defenders said the gas-pipes were made of the best material. The main was laid in 1877, in a safe and proper manner, and was thereafter, in the way appropriate thereto, periodically inspected by them. Until the date of the leakage it caused no trouble whatever to them. If subsidence took place in the ground in which it was laid, it was due to some cause which could neither have been anticipated nor prevented. It was admitted that leakage of gas took place, and that the gas found its way into the premises at No. 12, Carbeth Street. The escape was reported at the Corporation Gas Office at 5.50 a.m. on Dec. 28; and the leakage was stopped by 7.15 a.m. the same day. The death of the young woman was, it was said, due to natural causes. It was explained that gas-pipes were never enclosed in tar, or wood and tar, or other composition; and this main, when examined after the leakage was reported, was found to be, with the exception of a fracture, in good condition—neither corroded nor showing signs of corrosion. All the defenders' gas-pipes are coated or covered with Dr. Adam Smith's composition, which is an efficient permanent preventative against corrosion by chemicals or otherwise. This pipe was so coated, and was thus thoroughly protected against corrosion. The footpath in Carbeth Street was formed in 1875, upon ground which did not then, and does not now, contain ashes or chemicals of any description. The fracture in the pipe was due to some unknown cause. It was maintained that the defenders were not liable, in respect that they had duly discharged their statutory duty in laying, maintaining, repairing, and inspecting the pipe; and that the injuries sustained were not due to their fault. Also that, in any event, the damages claimed by the pursuers were excessive.

Counsel for the defenders said that a year and a day had elapsed since an issue for trial of the case by jury was adjusted; and the case not having been brought to trial by the pursuers within that time, he moved, in terms of Scotch law, that the defenders get absolvitor, with expenses.

The motion was granted.

Birkdale Council and the Price of Gas.—The Birkdale Urban District Council have decided to call the attention of the Board of Trade to the fact that the price of gas has not been reduced by the Southport Corporation, though it was suggested by members of the Board of Trade attending the inquiry when the application of the Southport Corporation was considered for permission to use the No. 2 "Metropolitan" argand burner for testing purposes, that if consent was granted, the Corporation should reduce the price of gas.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A meeting of the Finance Sub-Committee of the Gas Committee of the Glasgow Corporation was held yesterday, at which a very satisfactory statement of the accounts of the department for the year ending May 31 was submitted. The revenue was stated at £1,006,153, which is the largest in the history of the department. In the preceding year, the revenue was £865,470. After providing for the expenditure, the balance proposed to be carried forward is £35,489. Owing to the favourable price at which contracts have been made for the supply of coal during the current year, the Sub-Committee recommend to the Gas Committee that the price of gas be reduced by 3d. per 1000 cubic feet; making the rate for lighting purposes 2s. 1d. within the city and 3s. 1d. within the Milngavie area, and 1s. 9d. for trade and manufacturing purposes. These are the rates which were current during the year 1906-7, at the end of which 3d. per 1000 cubic feet was added, owing to the great increase in the price of coal. In the "Glasgow Herald" of to-day, it is stated that the importance of the recommendation is indicated by the fact that the reduction of 3d. per 1000 cubic feet on the output of gas in Glasgow is equal to £75,000 in the course of the year.

Last week I gave some notes from the report of the Directors of the Stirling Gaslight Company. At the annual meeting held on Tuesday, the Chairman said that the gas sold during the year amounted to 113 million cubic feet—an increase of 7 millions, or about 7 per cent., over the previous year. They had 195 new consumers, all of whom had elected to use prepayment meters. There had also been an increase of 166 stoves and 78 grillers. The amount collected in pennies from prepayment meters was £4272—an increase of £985. With a view to encouraging the use of gas-engines, the Directors had agreed to supply gas for this purpose at a reduced rate. Hitherto the price had been 2s. 10d. per 1000 cubic feet; now it would be 2s. 4d., according to the consumption. The improved retorts and mechanical stoker, while increasing the quantity of gas produced, had led to a reduction of over £250 in the wages bill, although the plant had been little over eight months in use; and improved methods of handling coke were expected to lead to further economies. Under the superintendence of Mr. J. D. Smith, the Manager, any new improvements which seemed likely to be of advantage were considered, and, if necessary, introduced. The report was adopted; and the dividends recommended, which were at the same rates as last year, were agreed to.

The doings of the Selkirk Gas Company are of interest, considering that a proposal for a transfer to the Corporation was, a few months ago, defeated by the ratepayers on a poll. In their report for the past year, the Directors have again pleasure in submitting a statement of affairs and balance-sheet which shows a very satisfactory result of the working of the Company during the year. The total make of gas during the year ended April 30 (the last period for taking meters) was 36,626,300 cubic feet—a decrease of 385,800 cubic feet; while the total quantity sold, used at the works, or otherwise accounted for, was 33,331,600 cubic feet. The quantity of coal carbonized was 3549 tons, yielding 10,318 cubic feet per ton. The works are in excellent order, and no expense on repairs, beyond the ordinary renewals of retorts, is anticipated this year; but the Directors have under consideration the roofing of the open yard, and the conversion of part of the premises into dwelling-houses for workmen. The Directors have contracted for 3660 tons of coal, at an average price of 14s. 7d.—equal to 6d. per ton less than last year. They recommend that no change be made in the price of gas. The profits for the year amounted to £906; and the Directors recommend that these be applied as follows: In payment of a dividend of 10 per cent. on the original share capital of £4535, £453 10s.; bonus at 2½ per cent., £113; depreciation account, £250; reserved against arrears, £50; and sum carried to surplus account, £39. The depreciation fund now amounts to £5926; and the value of stoves in the hire-redemption account is stated at £268. The value of the works, which includes £260 expended during the year, is stated at £21,484. The income for the year amounted to £5527, of which £4167 was derived from the sale of gas, £591 from tar and liquor, £549 from coke and spent lime, £73 from meter-rents, and £99 from waggon hires. The expenditure was £4621, of which coal, lime, cartage, and acid and outlay for sulphate amounted to £2915; pipes, bricks, retorts, utensils, and repairs cost £270; salaries and wages, £935; feu duties, taxes, and insurance, £330; Manager's and Treasurer's outlays, £68; and discounts paid on large accounts, £49. These figures bring out a very satisfactory year's working; but they are not pleasing to everybody. The defeat of the transfer scheme was, it may truly be said, entirely due to the fears created in the minds of the electorate by an anonymous writer in a newspaper published in Galashiels, but circulating largely in Selkirk. This gentleman returns to the business to-day, with a very long and forcibly—even studiously —arrogant criticism of the situation and actings of the party whom he calls the "Municipalizers." Fastening upon the statement in a pamphlet issued by this party at the time, to the effect that the average profit of the Gas Company for the previous five years was £1165, and that the annual outlay for interest, sinking fund, and depreciation would be £959, leaving an annual surplus of £206, he gleefully points to the profit for the past year having only amounted to £906, which is £53 below the amount which would have been required to pay standing charges. Going on to remark that only £40 of the £959 was allowed for depreciation, whereas the Company have set apart £250 for this purpose—or £210 more—he concludes that on the first year's working the Corporation would have been short in the gas account to the amount of £263, which would have been equal to 2½d. in the pound on the rates. This critic, in his jubilation, forgets two things. A year ago, the Company, in order to strengthen their position in the negotiations, in the event of their going to arbitration, in the face of an increase in the cost of coal, reduced the price of gas by 2½d. per 1000 cubic feet. They could easily have maintained the price. Had they done this, their revenue from gas would have been £380 more. The cost of coal, but for the rise in price, which is now almost a thing of the past, and would not have affected the Corporation management in this current year, was £160 more. These two sums of

£380 and £106, if added to the profit, would have increased it to £1446, or £281 more than the average for the previous five years, and £18 more than the sum which the critic assumes would have been the deficit for the year. It is to be borne in mind, too, that the figures criticized are those brought out by the Company, and not by the Corporation, who did not get the control of the undertaking. When looked at properly, therefore, the results of the year's working quite clearly bring out that the party who endeavoured to procure the transfer were in the right, and the party who opposed it in the wrong, so far as the community were concerned.

The Directors of the Kirkcaldy Gaslight Company, Limited, in their annual report, state that the manufacture of gas during the year amounted to 146,485,000 cubic feet, and the profit for the year to £5190. A dividend of 4s. per share is recommended; also that the price of gas be reduced from 3s. 4d. to 3s. 2d. per 1000 cubic feet. Last year the price was raised from 3s. to 3s. 4d. The output of gas increased during the year by 880,000 cubic feet, and as compared with two years ago by 5,257,000 cubic feet. The revenue for the past year was £1006 greater than that reported a year since.

The Directors of the Cowdenbeath Gas Company, it is announced, decline to entertain proposals which have been put before them for the transfer of their undertaking; and a meeting of the Town Council has been called to consider the procedure for a compulsory transfer.

The Jedburgh Gas Company was described by the Chairman, at their annual meeting this week, as standing in a very favourable position. The profit for the year was £303. It was agreed to pay a dividend of 6s. per share, equal to 5 per cent.—the ordinary dividend—and to carry forward £48. The price of gas was reduced from 5s. 10d. to 4s. 11d. per 1000 cubic feet.

The Alyth Gas Company have paid a dividend of 6 per cent., and awarded the Manager an honorarium.

There is a popular belief that the water supply of Glasgow is inexhaustible. This is not, however, shared by the Water Committee of the Corporation, who are about to undertake works for the augmentation of the supply, by bringing in the waters of Loch Arklet. It came, therefore, upon the community as a surprise, when the other day, in the midst of the very warm and dry weather which was being experienced, the Water Committee issued an advertisement, warning the inhabitants against the reckless misuse of water which was going on. There was, it was stated, enough water in Loch Katrine and in the reservoirs to satisfy every reasonable requirement, but the water-works could not cope with the unnecessary and excessive drain to which they were being subjected. During the previous few days, about 10 million gallons per day had been run off in excess of the usual daily supply. Such waste caused great inconvenience throughout the city, and especially to the inhabitants of the higher districts, whose supply was thereby rendered inadequate.

It was reported to the Dunfermline District Committee of the Fife County Council on Tuesday that an agreement was all but completed for a supply of water to Cowdenbeath from the Committee's works at Glenquay, which are in course of construction. The proposal is to furnish the Town Council of Cowdenbeath with a supply not exceeding 200,000 gallons per day, subject to the prior fulfilment of the Committee's obligations, under their Provisional Order, to their own district and to the other parties concerned, who are the Admiralty, for Rosyth, and the burgh of Inverkeithing; the prices to be at the rate of 5d. per 1000 gallons, with a minimum charge of £100 per annum. It was resolved to continue the negotiations. There is, it is understood, great difficulty being experienced in the construction of the dam for the Glenquay reservoir; and it is feared that water from it will not be available for about a year-and-a-half yet.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia.

LIVERPOOL, *July* 11.

The market has again been extremely quiet, and the tendency of prices is still in the downward direction, though production is now at its minimum. The export figures for June show a very marked decline from those for June, 1907, indicating that there is some accumulation of stock in the hands of makers; and this, no doubt, is encouraging buyers in their attitude of indifference. The closing quotations are £11 3s. 9d. per ton f.o.b. Hull, £11 5s. to £11 6s. 3d. per ton f.o.b. Liverpool, and £11 7s. 6d. per ton f.o.b. Leith. There has been more inquiry in the forward position, and some business has been done by makers for delivery up to the end of the year at the level of spot prices. But the inquiry is mainly for December-March and January-April; and for these positions makers for the most part refuse to quote, unless at prohibitive prices. Further speculative sales are, however, reported at very little above values for near delivery.

Nitrate of Soda.

This article is firmer in the forward position, in spite of the unfavourable statistical situation; and prices here are maintained at 10s. and 10s. 3d. per cwt. for 95 per cent. and refined qualities.

Tar Products.

LONDON, *July* 13.

The markets are quiet all round, and in most articles the outlook is not at all good. Pitch is still weak. London makers have accepted 19s. for January-June, 1909; and on the east coast 18s. has been accepted for September-December. In South Wales, 21s. 6d. has been taken for delivery to the end of March next. Creosote is steady. In London, from 2⅛d. to 2⅜d. is asked for prompt, and 2⅜d. for forward. In the Midlands, 2⅛d. is quoted; while in Yorkshire 2¼d. has been accepted and declined to the end of the year. Benzol 90 per cent. is weak, and prices have a downward tendency; while 50-90 per cent. benzol and toluol are very difficult to sell, buyers being well covered. Solvent naphtha is steady; but high-flash naphthas are quiet and in poor demand. Crude carbolic acid is neglected, and Continental consumers decline to make any offers for prompt delivery. Naphthalene is quiet. Creosote salts are not in much request; but prices are well maintained, owing to the demand for salty creosote. Tar is fetching good figures when the prices of products are considered.

The average values during the week were: Tar, 11s. 6d. to 15s. 6d., *ex* works. Pitch, London, 19s.; east coast, 18s.; west coast, 17s. 6d. to 18s. 6d., f.a.s. Benzol, 90 per cent., casks included, London, 7½d. to 7¾d.; North, 7d. to 7¼d.; 50-90 per cent., casks included, London, 7¼d.; North, 7d. Toluol, casks included, London, 7¾d. to 8d.; North, 7¼d. to 7½d. Crude naphtha, in bulk, London, 3¼d. to 3½d.; North,

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 91.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 10	10	Alliance & Dublin 10 p.c.	19—20	..	5 0 0
268,324	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
310,000	Stk.	Jan. 16	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
200,000	5	May 29	6¼	Bombay, Ltd.	6—6¼	..	5 0 0
40,000	5	,,	6¼	Do. New, £4 paid	4¼—4¾	..	5 9 6
50,000	10	Feb. 27	14	Bourne-mouth Gas and Water	10 p.c. 28—29	..	4 16 7
51,810	10	,,	7		B 7 p.c. 16½—16¾	..	4 3 7
53,200	10	,,	6		Pref. 6 p.c. 14¾—15¼	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	242—247	..	5 1 3
300,000	,,	,,	9¾	Do. New	180—185	..	5 2 8
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	June 12	4	Do. 4 p.c. Deb.	100—105	..	3 16 2
220,000	Stk.	Mch. 12	11¼	Brighton & Hove Orig.	205—210	..	5 7 1
246,320	,,	,,	8¼	Do. A. Ord. Stk.	152—157	..	5 5 1
460,000	20	Mch. 27	10	British	42—43	..	4 13 0
104,000	Stk.	Feb. 13	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	86—89	..	5 1 2
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	11—11¼	..	6 1 9
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	91—93*	..	4 6 0
150,000	20	Mch. 12	7½	Cagliari, Ltd.	24—25	..	5 16 0
100,000	10	—	—	Cape Town & Dis., Ltd.	4—6	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	5—7	..	6 8 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	46—48	..	6 5 0
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	88—90*	..	5 0 0
157,150	Stk.	Feb. 27	5	Chester 5 p.c. Ord.	111—113	..	4 8 6
1,493,280	Stk.	Mch. 12	5⅛	Commercial 4 p.c Stk.	104—109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	100—105	..	4 15 3
475,000	,,	June 26	3	Do. 3¼ p.c. Deb. Stk.	81—83*	..	3 12 3
800,000	Stk.	June 12	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	121—123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
148,995	,,	Mch. 31	5	East Hull 5 p.c. Ord.	100—103	..	4 17 1
486,090	10	Jan. 30	12	European, Ltd.	23—24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	16½—17½	..	5 2 10
15,182,590	Stk.	Feb. 13	4⅛	Gas-light and Coke	4 p.c. Ord. 97—99	+½	4 8 11
2,600,000	,,	,,	3½		3½ p.c. max. 87—90	..	3 17 9
3,799,735	,,	,,	4		4 p.c. Con. Pref. 106—109	..	3 13 5
4,193,975	,,	June 12	3		3 p.c. Con. Deb. 83—85	..	3 10 7
258,740	Stk.	Mch. 12	5	Hastings & St. L. 3½ p.c.	93—93	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	112—115	..	5 13 1
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	18—19	..	5 15 9
4,940,000	Stk.	May 14	8	Imperial Continental	179—182	..	4 7 11
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
195,242	Stk.	Mch. 12	6	Lea Bridge Ord. 5 p.c.	113—118	..	5 1 8
£			p.c.				£ s. d.
561,000	Stk.	Feb. 27	10	Liverpool United A	232—234	..	4 5 6
718,100	,,	,,	7	Do. B	165—167	..	4 3 10
306,083	,,	June 26	4	Do. Deb. Stk.	104—106*	..	3 15 6
152,736	Stk.	Feb. 13	7⅜	Maidstone 5 p.c.	136—141	..	5 8 2
75,000	5	June 26	6	Malta & Medn., Ltd.	4—4¾*	..	6 13 4
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 29	3½	Monte Video, Ltd.	11—12	..	5 16 8
1,775,892	Stk.	Feb. 27	4⅝	Newc'tle & G'tesh'd Con.	108—109	..	4 4 10
418,460	Stk.	June 26	3½	Do. 3½ p.c. Deb.	90—91*	..	3 16 11
15,000	10	Feb. 27	10	North Middlesex 10 p.c.	20—21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13¾—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	140—143	..	5 11 11
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	Apl. 29	7	Primitiva Ord.	6¼—6⅝	..	5 3 8
796,980	5	Jan. 30	5	Do. 5 p.c. Pref.	5—5¼	+⅛	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
1,000,000	10	Apl. 29	8	River Plate Ord.	13¼—13⅝	+⅛	5 16 5
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.	91—93*	..	4 6 0
250,000	10	Apl. 10	8	San Paulo, Ltd.	13¾—14	..	5 14 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51*	..	4 18 0
135,000	Stk.	Mch. 12	10	Sheffield A	244—246	—1	4 1 4
209,984	,,	,,	10	Do. B	244—246	—1	4 1 4
523,500	,,	,,	10	Do. C	244—246	—1	4 1 4
70,000	10	May 29	10	South African	13—14	..	7 2 10
6,429,895	Stk.	Feb. 13	5¼	South Met., 4 p.c. Ord.	118—120	..	4 8 10
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb	84—86	..	3 9 9
209,820	Stk	Mch. 12	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Feb. 27	5⅓	S'th Suburb'n Ord. 5 p.c.	116—119	..	4 9 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	122—127	..	3 18 9
502,310	Stk.	May 14	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 27	6⅔	Tottenham and Edmonton	A 5 p.c. 120—125	..	5 8 0
398,940	,,	,,	5¼		B 3½ p.c. 106—108	..	4 17 3
149,470	,,	June 26	4		4 p.c. Deb. 98—103*	..	3 17 8
182,380	10	June 12	8	Tuscan, Ltd.	10—10½	..	7 12 4
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97—99*	..	5 1 0
193,742	Stk.	Feb. 27	5	Tynemouth 5 p.c. max.	106—107	..	4 13 6
255,636	Stk.	Feb. 13	6½	Wandsworth and Putney	B 3½ p.c. 128—133	..	4 17 9
80,075	,,	June 26	3		3 p.c. Deb. Stk. 72—77*	..	3 17 11
845,872	,,	Feb. 27	5⅛	West Ham 5 p.c. Ord.	100—102	..	5 0 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
228,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.	100—105*	..	3 16 2

Prices marked * are "Ex div."

3d. to 3¼d.; solvent naphtha, casks included, London, 10d. to 10¼d.; North, 9d. to 9¼d.; heavy naphtha, casks included, London, 9¾d. to 10¼d.; North, 8¾d. to 9¼d. Creosote, in bulk, London, 2½d. to 2⅝d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2⅞d. to 3d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 5¼d. to 1s. 5½d.; west coast, 1s. 4¾d. to 1s. 5¼d. Naphthalene, £4 10s. to £8 10s.; salts, 32s. 6d. to 37s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1⅛d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market closes weak, and prices have been steadily declining throughout the past week. The principal London Gas Companies, who are practically out of the market now, quote £11 17s. 6d. on Beckton terms; but outside makes could be secured at £11 to £11 2s. 6d. In Hull, £11 2s. 6d. to £11 3s. 9d. has been accepted; while £11 5s. was taken for delivery over the next 12 months. In Liverpool, £11 3s. 9d. has been accepted. In Leith, £11 5s. to £11 7s. 6d. is quoted.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There is no change to report in the coal trade since the 1st inst., when house coal, and no other, was reduced 10d. per ton. Coal owners seem to be satisfied with things as they are. The reduction of 10d. per ton meant little or nothing to them, because the sales of house coal for the next two or three months will not be influenced by the reduction. The depression in the iron and cotton trades is relieving the pressure on the mine owners.

Northern Coal Trade.

There has been a rather better demand in the steam coal trade; but for steam smalls the output is full, and the price seems easier. Best Northumbrian steams are from 13s. 3d. to 13s. 6d. per ton f.o.b., with a full inquiry, second-class steams are 11s. 6d. to 12s. 3d., and steam smalls are easier at from 5s. to 6s. The production is heavy; but exports are well maintained, and the output thus readily taken up. In the gas-coal trade, there is a slight increase of the home demand, and there is also full foreign shipments, but quantities sent to the South are limited to those dispatched later in the year. Durham gas coals vary in price from 10s. to 11s. for the usual qualities, and up to 12s. per ton f.o.b. is quoted for Wear "special" classes. As to contracts, one or two have been closed, but not for large quantities. Some sales have been made for shipment into next year, at prices that are expected to leave about 9s. 9d. per ton f.o.b. for the coal. The contract for Rochester is confirmed much at the prices that have been previously named. Coke is steady; and the limited production of gas coke keeps up its price at somewhere near 15s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade remains as it was; the foreign demand being the better, and the home trade the slower. Small coal is very difficult to sell. Other varieties are meeting with ordinary summer inquiry, for home consumption. The prices quoted are: Ell, 10s. 6d. to 12s. 6d. per ton f.o.b. Glasgow, splint 10s. 9d. to 11s., and steam 10s. to 10s. 3d.—all the same as last week. The shipments for the week amounted to 337,526 tons—a decrease of 2312 tons upon the previous week, and of 228 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,369,567 tons—a decrease of 438,999 tons upon the corresponding period of 1907.

Gas Coal Prices.

A note in yesterday's "Pall Mall Gazette" says: The heaviest portion of the home business in the arrangement of gas-coal contracts has now been put through, though one or two large buyers—notably Sheffield—have yet made no move. The argument between producers and consumers has been an interesting one; and, on the whole, the honours are fairly evenly divided. The collieries at first stood out for the same prices as last year. But, finding it impossible to maintain such a demand, they agreed to accept 6d. per ton less; and, notwithstanding a steadily weakening market, they appear to have secured a large proportion of business on this basis. This, however, applies only to the best qualities of gas coal, which have been bought most largely by gas-works at long distances from the place of production; for the best coal costs no more in carriage than the worst. There is no doubt, on the other hand, that very heavy tonnages of cheap coal have been purchased; and, compared with the price paid for the same qualities a year ago, the saving is generally 1s., and in many cases 1s. 6d. per ton. With regard to foreign business, the Germans are making strenuous efforts to capture the Italian trade; and Hamburg merchants have already made large speculative sales at the chief Italian centres.

New Joint-Stock Companies.—The Syndicate Lamp Company, Limited, has been registered with a capital of £2000, in £1 shares, to adopt an agreement and carry on the business of manufacturers of, and dealers in, filament or other lamps, &c. Under the title of "M. H. (Methane-Hydrogen) Gas Plant, Limited," a Company has been registered with a capital of £30,000, in £1 shares, to adopt an agreement with Messrs. Biggs, Wall, and Co. and Mr. C. B. Tully. The first Directors (not less than three nor more than seven) are Mr. W. Wall (permanent; special qualification, one-quarter of shares allotted to him under purchase agreement), and others to be appointed by the signatories. The Southbank Tar Macadam Company, with a capital of £20,000 in £1 shares, is to take over the business carried on by Mr. J. Robinson, at Northgate, Darlington, Southbank, near Middlesbrough, and at Coatham, near Redcar, as the Southbank Slag and Tar-Macadam Company.

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The New Issue of Stock of the Tottenham and Edmonton Gas Company.—Reference was made in the "JOURNAL" a few weeks ago to the intended issue of £25,000 of "B" stock of the above-named Company. We learn that the issue was over-subscribed, at prices ranging from £107 to £110 per £100. Tenders at £107 5s. and upwards were allotted in full; while those at £107 received 60 per cent. of the amount applied for.

Suicide by Gas Poisoning at Manchester.—A man named Heap, 72 years of age, who was formerly a pipe-fitter in the employ of the Corporation, committed suicide at Manchester last week. He wedged the bottom of the bedroom door with wood and clothing, and then took the gas-bracket off the pipe in the wall. Having made a hole in a pillow, which he fixed over his head, he sat on a box level with the lead gas-pipe, and was thus asphyxiated. The Coroner's Jury returned a verdict of suicide.

The Labour Trouble at the Budapest Gas-Works.—According to a telegram which reached London early last week through Reuter's Agency, the negotiations between the Gas Company and the workmen on strike led to nothing, though the men abandoned their demand for the reinstatement of their 27 dismissed comrades. The Directors of the Company declared they would only re-engage 600 of the strikers; the other vacancies having already been filled up. A later telegram, dated the 8th inst., and received through the same Agency, stated that, as the result of the intervention of the Government, the management of the gas-works had taken back all the employees with the exception of five, who committed excesses during the strike, and did damage to the works.

East Surrey Water Company.—At the recent annual general meeting of this Company, under the presidency of Mr. Peter Riddoch, the Directors reported that the profit for the year ending the 25th of March was £26,323, which was increased to £29,742 by the addition of the balance brought forward. The Directors recommended dividends of 5 per cent. upon the preference shares, 10 per cent. upon the original shares, and 7 per cent. upon the "B" shares (all less income-tax), which would leave a balance, after placing £1500 to the residual and contingency fund, of £3404 to be carried forward. In moving the adoption of the report, the Chairman stated that it was intended to build a new service reservoir at Caterham, in order to keep up a thoroughly good supply in their high-service district. The report was adopted, and the dividends recommended were declared. In the course of the proceedings, the Chairman moved that the thanks of the meeting be accorded to the staff, who, he said, gave their very best attention to the interests of the Company. In seconding the motion, the Deputy-Chairman (Sir Myles Fenton) said he thought the shareholders were extremely fortunate in having Mr. Cornewall-Walker as their Engineer, Manager, and Secretary, for he devoted the whole of his time and the best of his experience to their service; and he was ably seconded by the staff. The motion was carried unanimously and briefly acknowledged by Mr. Walker.

Improved Lighting of Southwark Park.—The London County Council last Tuesday decided to improve the lighting of the carriage road through Southwark Park, which is open throughout the night. Three additional lamps will be provided, the positions of the existing lamps will be altered, and the Council's gas-main through the park will be connected with the principal mains in the roads outside; the two meters at present in use being dispensed with. An agreement is to be entered into with the South Metropolitan Gas Company to light, clean, and maintain the lamps under an arrangement similar to that for the ordinary street lighting, at a charge of £3 6s. per lamp per annum.

Sulphate of Ammonia Manufacture in North Wales.—According to a paragraph in the "Chemical Trade Journal," at a recent meeting of the Denbigh Town Council a letter was read from the Secretary and Manager of the Denbigh Gas Company, stating that a Company had been formed for the manufacture of sulphate of ammonia from the ammoniacal liquor from several gas-works in North Wales. It was suggested that the proposed works should be established at Denbigh, and permission was requested to run the effluent into the Council's drains. It was pointed out that similar works were established at Wrexham; and the Denbigh Council referred the matter to a Committee, on the understanding that if inquiries at Wrexham proved satisfactory, permission for the effluent to pass into the drains would be given.

Local Ironmongers at the Croydon Gas-Works.—We learn from the "Ironmonger" that, at the invitation of the Chairman and Directors of the Croydon Gas Company, the members of the Croydon Ironmongers' Association inspected the Company's works at Waddon last Wednesday afternoon. They were received by Mr. Charles Hussey, J.P. (Chairman), Mr. J. W. Helps, M.Inst.C.E. (Engineer and General Manager), and Mr. A. Caddick (Assistant-Engineer). In conducting the members over the works, Mr. Helps fully explained the details of gas manufacture, including the process of making water gas. At five o'clock the members were entertained at tea by the Directors in the board-room—Mr. Hussey occupying the chair, and Mr. Helps the vice-chair. After tea Mr. W. Wright proposed a hearty vote of thanks to the Chairman and Directors for the opportunity they had given the members of the Association to visit the works. This was seconded by Mr. R. H. Smith (the Secretary of the Ironmongers' Federation), who stated that he had visited many large gas-works in the country, and that it was a pleasure for him to testify that the Croydon works were in no way second to any he had seen. It appeared to him that the Croydon Gas-Works might well be designated as model ones. Mr. Hussey, in returning thanks, stated that during the sixteen or seventeen years he had been connected with the Company a marvellous increase had taken place in its development; and he paid a high tribute to the Engineer. Mr. Helps stated that when he went to Croydon in 1884 the total output of gas was 283 million cubic feet, whereas now it was 1250 millions; and the Company distributed gas over 80 square miles. He was particularly pleased to hear what Mr. Smith had said about the works, because he (Mr. Helps) knew the speaker had visited many similar establishments all over the country.

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Some days ago, a fire broke out in the tar distillery department at the Rochdale Gas-Works. The employees at once attached a jet to a main, and a good supply of water was poured on the burning tar. The fire was thus well under control by the time the brigade arrived at the works, and the outbreak was soon extinguished. The damage caused was slight.

The British Westinghouse Electric and Manufacturing Company, Limited, have received an order from Messrs. Tweedales and Smalley, of Castleton, Lancashire, for one of their latest type of tandem vertical gas-engines, to be direct-coupled to a direct-current generator of a combined capacity of 500 kilowatts when running at 110 volts, with switchboard complete. It forms an extension to the 235-kilowatt gas-engine sets recently put into operation.

The annual outing of the employees of the Gorleston and South-town Gas Company took place on the 4th inst. The party journeyed by brakes to Coldham Hall, where dinner was served. In the absence of Mr. J. Witten, the Engineer and Manager, Mr. E. F. Keable, the Assistant-Manager, presided. After dinner, votes of thanks were passed to the Chairman and Directors of the Company for their continued liberality; to Mr. Witten for his support in arranging for the outing, assisted by Mr. Keable; and to Mr. W. Poll, for again carrying out the duties of Secretary. Tea was served at Blofield, from which place the party returned home well satisfied, after having spent a most enjoyable day.

The gas-works authorities of the Corporation of Ghent have placed an order for the erection of plant on the Kramers and Aarts patent system, capable of producing 500,000 cubic feet of water gas per diem, for the sum of £5340, which does not include building. The order was obtained in competition.

"British tube makers report," says "The Times," "that the war of prices which is now being carried on in the trade is having disastrous consequences for all engaged in the industry. The export branch is suffering largely, for in that field the competition of Continental and American makers has to be faced; but even in the home section the competion has also to be reckoned with. It is stated that all list quotations have dropped, and each individual transaction has to be negotiated very much according to the wishes of buyers. In some cases net prices have been reduced by as much as 25 per cent. on the terms that were commanded a fortnight ago. Lower prices than those current now have ruled before; but when the range of costs is considered, it is thought that actual net returns were never poorer than at present. The prospects, therefore, for producers are serious. Consumers, while benefiting, are not in the position, from lack of work, to take full advantage of the opportunity they possess; but several firms who have an outlet for standard sizes are said to be laying in stock, and this will tell against demands when business once again returns to its normal state, which, it is suggested, may come sooner than many people think. If something in this direction is not soon done, disaster, it is asserted, is inevitable in more than one centre of production."

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No. 7.—"The Osram Lamp: Fiction and Fact."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

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NEWHAVEN AND SEAFORD WATER COMPANY. Particulars from the Company.
PORTSMOUTH WATER COMPANY. July 28.

TENDERS FOR

Coal and Cannel.

BELFAST GAS DEPARTMENT. Tenders by July 23.
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RAMSGATE CORPORATION. Tenders by July 20.
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The one Machine which Discharges and Charges at One Stroke.
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BLUE WATER GAS, CARBURETTED WATER GAS, SELF-CARBURETTING.
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ANY QUANTITY. ANY PORT. ANY STATION.
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ENGINEER, with wide Technical and Commercial Experience, acquired at Home and Abroad, well Educated, of Good Appearance and Manner, desires to Communicate with Firm of Good Standing, preferably one Manufacturing Gas-Works Plant or Appliances for the Mechanical Handling of Materials, with a view to REPRESENTING them in London or in the Colonies. Advertiser has been Engineer to large Gas-Works, and is at present Manager in an Engineering business in London.
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Address, in first instance, "Gas," c/o Carr, 8, Queen Street, Cheapside, London, E.C.

AUTOMATIC Meter Collector (Junior), required by a Gas Company near London.
Apply, by letter, stating Experience, Age, References, Salary required, and when Disengaged, to No. 4965, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, an Assistant to the Manager for Three or Four Weeks during Main and Service Laying through High Street, Eton.
Reply, stating Salary required, with References, to the SECRETARY, High Street, Eton, BUCKS.

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WANTED, immediately, an Experienced General CARBONIZING and WORKS NIGHT FOREMAN, for a Works producing 500 Millions per Annum, one who thoroughly understands Machinery as used in a Gas-Works, and who should have held a similar Appointment elsewhere.
House, Coke, and Gas free.
Apply, stating Age, Wages, &c., required, together with not more than Three *copies* of recent Testimonials, to No. 4966, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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Apply, by letter, enclosing *copies* of Testimonials and Stating Wages required, to ERNEST A. FRANKS, Gas-Works, Ferndale, GLAM.

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WANTED to Purchase, in the Southern and Eastern Counties, LIQUOR for use at Experimental Works to be erected near where bought.
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Gasholder, 8500 cubic feet, New Steel Tank.
Gasholders, 35 ft. by 10 ft., Cast-Iron Tank.
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" 50 ft. by 15 ft. 4 in., Telescopic,
Overhauled and re-erected in new Steel Tanks.
8-inch, 9-inch and 10-inch Condensers.
New "Cripps's" Washer, 8-inch Connections, 200,000 cubic feet per day.
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Producer-Gas Plants for 150 to 300 H.P.
Boilers, Tanks, and all requisites for Gas-Works.
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THE Hastings and St. Leonards Gas Company have still some useful SURPLUS PLANT for Disposal, which is well worth the attention of anyone requiring such.
This Plant (including Retort-House Fittings, Purifiers, Exhausters, Washers, Meters, Girders, Connections, &c., Particulars of which will be furnished on Application) is suitable for Works up to 1½ Millions per diem capacity, and is only out of use owing to the new Glyne Gap Works.
CHAS. E. BOTLEY, M.Inst.C.E.,
Engineer and General Manager.

THE Haworth Urban District Council are prepared to receive TENDERS for the Supply of 2500 Tons of GAS COAL (Screened, Unscreened, and Gas Nuts), delivered at the Haworth Station during the ensuing Twelve Months.
Sealed Tenders, endorsed "Gas Coal Tender," to be forwarded to me, the undersigned, not later than the 25th inst.
No Special Form of Tender.
WILLIAM ROBERTSHAW,
Clerk to the Council.
1, Burlington Chambers,
North Street, Keighley.